Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

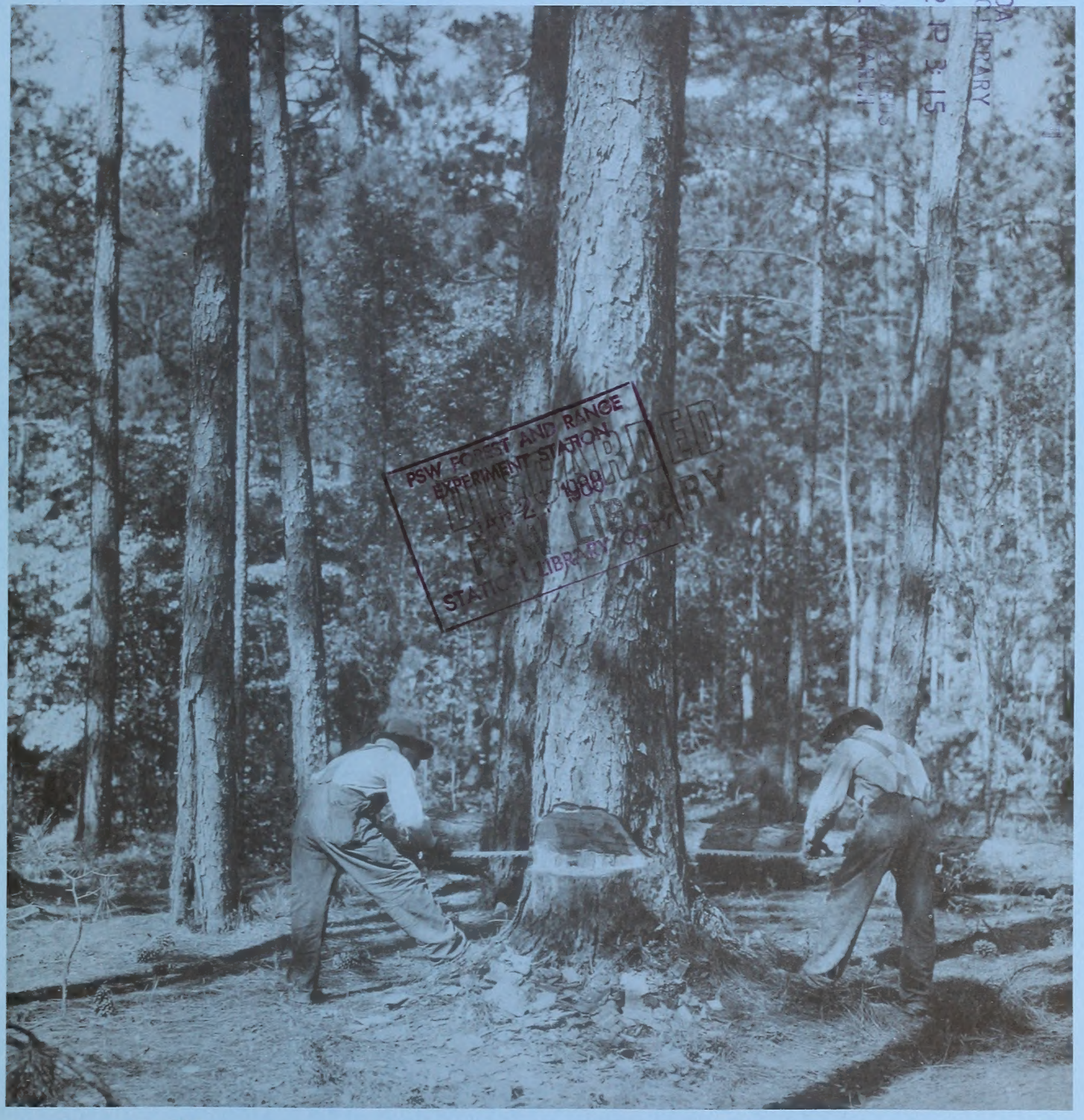
SHOUT
SHARE
IT

aSD11
U5936
c3

United States
Department of
Agriculture

Forest Service
Southern Region

LONGLEAF PINE
A History of Man and a Forest



USDA NAT'L AGRIC LIBRARY
1999 FEB 12 P 3:15
CURRENT SERIALS
ASD/SERIAL RECORDS

PSW FOREST AND RANGE
EXPERIMENT STATION
MAY 20 1988
UNCLAIMED
LIBRARY
STATION LIBRARY COPY

Forestry Report R8-FR 7
October 1987

LONGLEAF PINE:
A HISTORY OF MAN AND A FOREST

by

Thomas Caldwell Croker, Jr.

USDA Forest Service
1720 Peachtree Road NW
Atlanta, GA 30367-9102

CONTENTS

PREFACE 1
DEDICATION 2
ACKNOWLEDGEMENTS 2
THE VIRGIN FOREST 3
THE INDIANS 3
THE PIONEERS 5
CHANGING TIMES 7
BOOM TIMES 10
THE GREAT DEPRESSION 13
FOREST FIRE HERESY 16
THE SECOND FOREST 18
WORLD WAR II 20
POSTWAR PARADOX 21
STEMMING THE TIDE 26
A PLACE IN THE SUN 33
SELECTED BIBLIOGRAPHY 36

PREFACE

The land of the longleaf pine is a giant stage, stretching across the lower South, where centuries of human drama have been enacted. Indians enjoyed a compatible home in these woods until defeated and evicted by whites. Spanish Conquistadores trampled the pineywoods in search of gold. Finding none, they were soon discouraged and left. Later, Scotch, Irish and other Europeans came seeking freedom from oppression and built permanent homes. Lumbermen, turpentiners, foresters, and many others have played a significant role in the drama.

There have been times of great rejoicing and prosperity, but also grim times with little hope for the future. Fortunes have been made and lost. Red, white, and black men have sweated, bled, and died under the longstraw crowns.

Like many Southerners, longleaf pine forests have played an important role in my life. Tales of my early ancestors have wedded me to them. I spend much of my youth, college days, and professional forestry career in them.

Because of my association with the land, people, history, and management of the forest, this story is written from a personal viewpoint. It has, of course, been fleshed out with gleanings from the publications listed in my selected Bibliography and information supplied by others.

My objective is to provide a story for the enjoyment and enlightenment of people who love or can be encouraged to love longleaf pine. Among them are those whose livelihood or that of their ancestors has come from the forest; those who have enjoyed hunting quail and other game in the parklike woods; foresters who have tackled the demanding task of managing the species; those who have battled to save this splendid natural resource from extinction; any having a personal relationship with longleaf pine.

There are many others, among them lovers of the history and folkways of the South. Longleaf pine people are as typical of the South as "grits and gravy." Also, conservationists anywhere might profit from reading this story.

Basically, I have another more important purpose for this book. Longleaf pine forests have weathered two crises that threatened their extinction. In the late 1800s lumbermen moved in and ruthlessly clearcut most of the virgin timber with no thought of regeneration. Except for a few tracts conservatively cut by far-sighted lumbermen and land that was diverted to agriculture, millions of acres lay bare and bleaching in the sun. Forest workers, unemployed, were left in hopeless poverty.

Largely without the help of man, a second forest arose from the ashes and debris of the virgin timber. But again destroyers moved in. By 1960 it appeared likely that it would be completely gone by the mid-seventies with no hope of renewal. Clearcutting followed by heavy site-preparation guaranteed its elimination. Objective of the destroyers was to replant the land with slash or loblolly pines that could be managed easier -- requiring less skill.

Alarmed, lovers of longleaf pine took aggressive action to prevent its demise as an important commercial forest. The dangerous trend was slowed down and about 4 million acres were saved -- a paltry remnant of the original 60 million acres of virgin timber.

But a new day has dawned. Unfounded prejudices against longleaf have gradually faded away and there is renewed interest in growing the species. It is my belief that this story will help accelerate this desirable trend.

DEDICATION

This book is dedicated to a future for longleaf pine, one of the finest forests that the world has ever known.

ACKNOWLEDGEMENT

Special thanks to members of the Forest Service in Atlanta for editing and publication: Stan Adams, Roger Dennington, and Sharon Young. Others who provided information and encouragement were Thomas Ellis, director of the SOFES (Southern Forest Experiment Station); John F. Kelly, SOFES; Aleta Hayden, librarian, SOUTHFORNET: Dr. Larry Walker, Stephen F. Austin University; Dr. Arthur W. Cooper, North Carolina State University; L.M. Goodwin, Jr., Weymouth Woods, Southern Pines, NC; Dr. Claude Brown, University of Georgia; William Voit, Jr., Blackshear, GA; Larkin Wade, Alabama Extension Forester; and Harold K. Steen, Editor, Journal of Forest History.

Also, thanks to the authors of the publications listed in the selected Bibliography for material used in this publication.

THE VIRGIN FOREST

Open and parklike, the virgin longleaf pine forest dominated some 60 million acres of the prehistoric southern landscape. Like huge wooden soldiers lined up in battle formation, the massive trees dotted the rolling Coastal Plains in a sea of grass. Gentle breezes, laden with a resinous perfume, rippled the longleaf crowns and generated music, soothing to the ear and slightly mournful. Occasionally, the tranquil scene was disturbed by a killer hurricane that crashed ashore from the sea felling many veteran trees.

The forest, laced with narrow stream bottoms of hardwood and cane, provided an ideal habitat for deer, turkey, quail, and many other animals and birds. Beginning at the extreme southeastern tip of present day Virginia, longleaf's natural range extended across the Atlantic and Gulf Coastal Plains into east Texas, with brief excursions into the mountain and piedmont areas of Alabama and Georgia. It was hemmed in by aridity on the west and by freezing temperatures and heavy soils on the north.

Fire was a natural architect of the forest. Ecologists classify longleaf pine as a "fire climax" type, meaning that the tree is maintained by regular fires. They speculate that the species' affinity for sandier soils is connected to a complex fire relationship. On such soils, the ground vegetation consists of coarse, flammable grasses. Fires, originally set by lightning and later by Indians, frequently spread over thousands of acres in this fuel type. Longleaf seedlings, endowed by nature with supreme resistance to fire damage, found a compatible home in this environment. In fact, their very survival depended on these fires. Without fires, aggressive hardwood and pine competitors would choke out the longleaf. The open, parklike nature of the forest was due to the clearing action of fire.

The forest was a bountiful storehouse of valuable wood products. Foresters have estimated that the original timber stands contained over 200 billion board feet of the strongest building material for homes and numerous other structures as well as timber for poles, piling, railroad ties, and many other useful products.

In dead and down timber, an abundance of pitchy wood unsurpassed for kindling, torches, house sills, and fenceposts was stored on the forest floor.

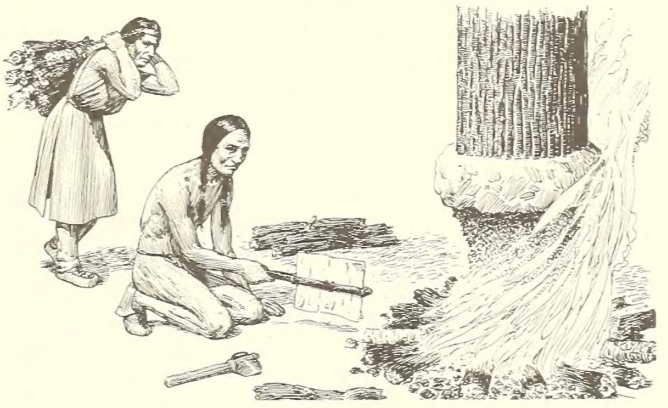
Also, pitch and tar could be derived from longleaf heartwood to waterproof ships. Later, trees wounded by naval stores operators exuded oleoresin from which turpentine and rosin were stilled.

Admirably adapted to the southern environment by its resistance to fire, insects, and other hazards, longleaf pine stands were guaranteed continued renewal through natural processes. Many seedlings established on the forest floor by infrequent seed crops escaped damage from light surface fires. When mature trees were killed by lightning or felled in hurricanes, seedlings sprang up to repair breaks in the canopy.

Would man wisely use this natural resource? Unfortunately, our story will reveal that this has not always been the case.

THE INDIANS

The story of the first man to enter the longleaf pine forest is lost in centuries of unrecorded history. Since the forest apparently dominated such a large portion of the land, we can assume that it profoundly affected the earliest human inhabitants. We do know something of the activities of the Indians in this forest from journals of the first European visitors.



Because of primitive cutting tools Indians had to use fire to fell large trees.

Longleaf forests provided many of the necessities of life for woodland Indians of the southeast. Heartwood furnished fuel for warming and cooking fires. The warming fires were built on the ground in the center of the wigwam or lodge, and the smoke escaped through a hole in the roof. Soot that collected on walls was scraped off and mixed with bear oil for war paint and other ceremonial painting. Lighterwood splinters illuminated the way on night excursions. Small trees and bark from the pineywoods were used to construct corn cribs, lodges, and other small structures. Many village streets were paved with pine bark.

Deer furnished Indians with food, shelter, clothing, and deerskins became an important item of trade after the white man arrived. The longleaf pineywoods provided an ideal locale for hunting the plentiful deer, which, when threatened by enemies, would hide in the narrow branch bottoms that penetrated the open woods. Hunters soon learned to drive deer from their hiding places with fire, making death traps of the dense cane and hardwood bottoms. While their companions set the fire hunters hid behind tree trunks in open woods and killed the deer as they rushed out to escape the flames.

When the Indians' hunting fires were not extinguished, flames spread throughout the uplands until stopped by a stream or by rain. These fires often blackened streams when ashes washed into them.

In addition, wood products were important in many aspects of Indian ceremonial life, including funerals. Mourners blackened their faces with soot mixed with bear oil. The corpse was laid out in the sun on a pole frame, covered with pine bark, and treated with various mixtures. As soon as the flesh was cooked, it was removed and burned. The bones were then cleaned, oiled, and preserved.

Indians' clearings for gardens and field crops were rarely extensive in longleaf pine forests. The native Americans favored richer soils near streams rather than the sterile soils of the pineywoods. Moreover, until white traders brought axes and other metal cutting tools, land clearing was a slow process. Larger trees could not be felled with primitive cutting tools, instead they were deadened by girdling or killed by piling heartwood around the tree base and setting it on fire. No doubt many clearings reverted naturally to pine.

On balance, the Indians did not materially change the character of the virgin forest. Their widespread use of fire helped maintain its open nature, and millions of acres of parklike stands stretched across the Southland when the white man came.

Virgin forests of longleaf pine were parklike.

The first white men to enter the longleaf pineywoods were Spaniards in search of gold. Typical was Hernando DeSoto, who in 1539 came ashore to Florida from his base in Cuba with a large company of armor clad soldiers. DeSoto traveled through the Carolinas, Florida, Georgia, Alabama, and Mississippi. His brutal treatment of the Indians generated hate for whites. Several battles were fought and won by the Spaniards. The crude weapons of the Indians were no match for the swords and spears of the mounted, armor-clad soldiers.

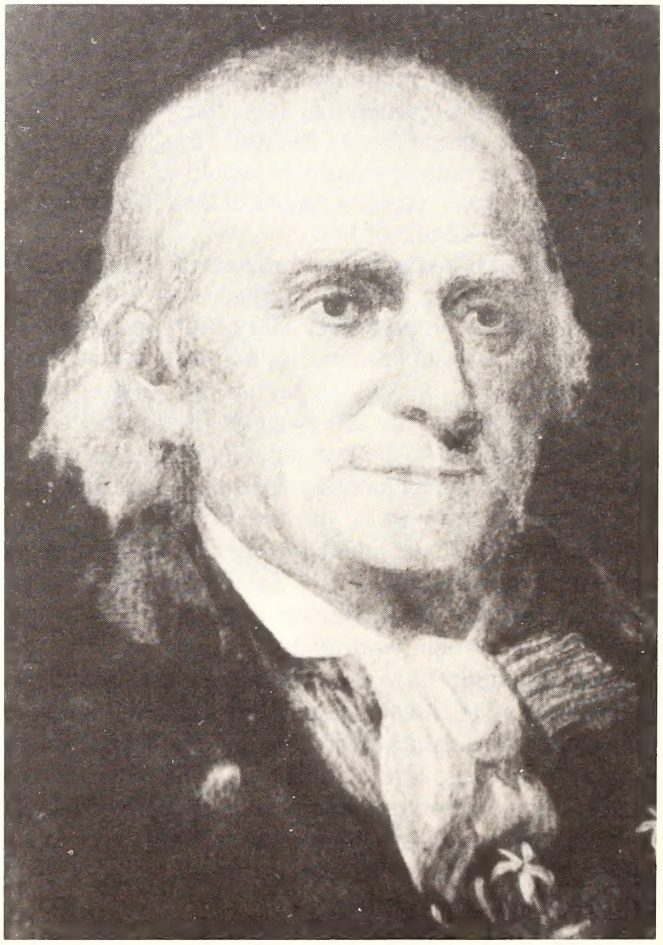
To provide food, the conquistadores brought along herds of cattle and hogs. Some hogs escaped and their descendents, known as razorbacks, became a serious menace to longleaf pine seedlings.

Razorback hogs, a serious threat to longleaf pine seedlings, were introduced by DeSoto and other Spanish conquistadores.

DeSoto died on the western leg of his trip and was buried in the Mississippi River by his men to prevent hostile Indians from desecrating his grave.

In 1708 John Lawson, an English gentleman by birth, arrived at Charleston, South Carolina and made a trip through Indian country in the Carolinas. He wrote a detailed description of his observations and relations with Sewee, Santee, and Tuscarora tribes that he encountered in the Coastal Plains of South Carolina and North Carolina. The Indians treated him kindly, guided and hunted for him on his travels, welcomed him into their villages, honored, bedded, and fed him there. He was aghast to see the ravages that the white man's social diseases and whiskey had wrought on the "savages," especially their treatment of the women. Later, when he returned to North Carolina on a second trip he was captured, tortured, and killed by the Tuscaroras. Kidnapping of their children and taking them to England, presumably for education and conversion to the Christian religion, had incensed the Indians.

William Bartram, the Quaker naturalist from Pennsylvania, toured longleaf pine forests in the late 1700's. His travels took him into the Carolinas, Georgia, Florida, Alabama, and Mississippi. He praised the open, airy nature of the virgin pineywoods in the sandy uplands that he liked so much better than the mosquito infested, dismal, cane brakes. During his trip he kept a detailed journal of the flora, fauna, and lifestyle of the Indians: Creeks, Choctaws, Seminoles, and others.



William Bartram, famous Pennsylvania naturalist, explored the longleaf pine forests in the 1770's.

Bartram fortunately secured the blessing of several chiefs at a Georgia meeting that protected and smoothed his travels through Indian country. Purpose of the meeting, held at Augusta, was for John Stuart, the Indian agent, to finalize arrangements with the natives for sale of a large tract of their land to white settlers.

The naturalist noted that coming of the white man had changed the lifestyle of the Indians. Traders brought axes, hoes, guns, and many other items that replaced their crude possessions. With metal cutting-tools they were able to clear larger fields for corn, potatoes, beans, and other vegetables. Lumber in their towns provided material for building structures, which replaced the crude huts, cribs, and lodges of earlier times. He saw large herds of cattle tended by Indian cowboys mounted on horses introduced by the white man.

Bartram reported woods fires set by Indians as well as their use of lighterwood for cooking and warming fires, and a few structures made of longleaf pine trees.

He was treated with courtesy wherever he went. The Indians helped him with his baggage, guided him through the wilderness, transported him in leather boats and rafts across wide streams, killed game, and provided fish for his food. Besides venison, bear steaks, hominy, and a wide variety of native food, he was probably fed the delicious meat of carrier pigeons.

Hunters, equipped with a supply of lighterwood splinters, bags, and clubs, located the pigeons roosting in large oak trees at night. Suddenly they would light splinters creating a blaze of light that blinded and stunned the birds. Many dropped to the ground and were clubbed to death and collected in the bags.

Bartram's friendly relations with the Indians was not typical. Bitter conflicts developed between the two races. The natives resented invasion of their homeland and struck back viciously. At Fort Mims in southwest Alabama, 550 men, women, and children were massacred in August 1813 by Creeks under William Weatherford, a half-Indian chief, known as Red Eagle. To protect settlers, walls made of pine poles had been set in ditches. But the gate, carelessly left open by soldiers, was stuck in sand and could not be closed when the warriors attacked.

Later, Tennessee volunteers under General Andrew Jackson trapped the Creeks in central Alabama at Horseshoe Bend and wiped out most of Red Eagle's warriors.

In pitched battles throughout longleaf pine country the Indians were defeated by whites. Many were forced to move to arid lands in Arkansas and Oklahoma. Seminoles in Florida were undefeated and fled to a sanctuary in the vast Everglade Swamp.

Soon after the turn of the 19th century, most Indians were gone except for a few Creeks in Alabama, Choctaws in Mississippi, Croatans in North Carolina, Seminoles in Florida, and a few others.

Here and there vestiges of the earlier residents remain: old fields, remnants of towns, burial mounds, arrowheads and other artifacts. Ashes from warming and cooking fires have long been dissolved by rain, and the virgin longleaf forest was left, largely intact, in the hands of the white man.

THE PIONEERS

Highlanders from Scotland, Scotch-Irish from Ireland, and Huguenots from France were among the first white settlers to establish permanent homes in the land of the longleaf pine. Most earlier pioneers had left.

After defeat in the battle of Culloden in Scotland (1746), the Highlanders' clan system was destroyed and landlords kept them from making a living on the land. The situation in Scotland became intolerable. Glowing reports from some who had emigrated earlier enticed hundreds of Gaelic speaking Scots to move to the Cape Fear River Valley of North Carolina.

Also, Scottish Presbyterians had been moved from the lowlands of Scotland to northern Ireland by the English King to provide a buffer against the Catholics. But the Scots were persecuted by the Church of England and were not allowed to sell their cattle and other produce in competition with English merchants. Disgusted with religious and economic persecution, great numbers of them, known as Scotch-Irish, braved a dangerous crossing of the ocean, to seek freedom in America. Many came to Charleston, South Carolina.

In France, dominated by Catholic rulers, Protestants were brutally murdered. On St. Bartholomew's Day, 100,000 Calvinists were killed. Hundreds of French Huguenots, to escape religious persecution emigrated to Charleston, South Carolina in the 1700's.

Crossing the Atlantic in leaky wooden ships, powered by sail, was a fearsome adventure. Often the passengers had to help sailors man pumps to keep the ship from sinking during storms. Crowded in unsanitary quarters, with bad food and water, suffering with sea sickness and other ills, many died on the way to the promised land.

But the Scotch-Irish and Huguenots did not remain long in Charleston. After their fearful voyage, they made arrangements to acquire tracts of land, purchased some supplies and livestock, then continued inland to establish homes in a wilderness forested with vast pine uplands and dismal swamps. The lowland was penetrated by many rivers: Santee, Black, PeeDee, and others that were the main highways to Charleston and Georgetown. There were few roads, and ferries to cross the river were miles apart.

Terror and hardships awaited them in the forests. Plagued by clouds of mosquitoes, they were terrified at night by strange sounds: the scream of panthers, screech of owls, and booming of alligators. Rainstorms often doused their fires and left them wet and miserable, having to borrow live coals from neighbors. Brush arbors, log shelters, and lean-tos were slim protection from the elements. More substantial homes would have to be built. Always there was the fear of Indians and rattlesnakes. It was easy to become lost in the trackless wilderness. Without lumber for coffins the dead were wrapped in a blanket for burial.

But they were agreeably surprised when some of the natives drifted into their camps, were friendly, and offered to exchange corn, and other needed supplies for trading goods the settlers had thoughtfully brought along.

Knowledge imparted by the Indians was even more useful: how to start fire with friction; how to clear land by girdling trees; hunting tricks so they could supplement

their food supplies with deer, turkey, ducks and other woodland game; identification of useful plants, and much more.

Since the rivers were their primary means of transportation they cleared homesites near them in soils usually richer than the sterile pine lands and more suitable for growing crops and gardens.

At first they built log cabins. Later, more substantial homes replaced the cabins when rough lumber became available. Lumber was pit sawn from logs cut with axes from virgin longleaf pines. Over a century would elapse before the more efficient crosscut saws could be invented.

Pit sawing was a slow, laborious process. One man stood on a trestle over the log, snaked into position with oxen, and handled a saw that cut only on the down stroke. The other man worked in the pit and got a face full of sawdust. Only a few boards were produced in a hard day's work.

Buildings were constructed with precious nails imported from Europe or hand-made by a local blacksmith. Heartwood, virtually immune to decay, was collected for house blocks and sills.

The devoutly Christian settlers built churches even before their homes were completed. Many were crude structures, fashioned from logs, without chimneys or any means of heating. The hardy pioneers did not believe that worshipers needed to be comfortable during services.

Gardens and crops were tended mostly by hand with hoes, although a few people rigged-up crude plows to be pulled by oxen. The settlers planted Indian corn, following advice of their native friends, instead of wheat that did not do as well. With seed and transplants, obtained from the Indians or brought from Europe, a great variety of garden crops were grown: sweet and Irish potatoes, beans, English and blackeyed peas, squash, melons, and the like.

Highland Scots migrated to Wilmington, North Carolina. Upon arrival at Wilmington, the Scots arranged for boats to transport them up Cape Fear River to Cross Creek (site of modern Fayetteville). Taking up land in Cumberland and adjoining counties, dominated by longleaf pine forest, they faced a wilderness experience like that of the settlers who migrated to Charleston. But there were some differences. Climate in the sandhills was move liveable than the more humid summers in South Carolina lowlands and mosquitoes were not as troublesome. The fierce Tuscarora Indians had been driven out, and there were not many Catawba and Croatans. So they probably had less contact with Indians.

Ancient Old Bluff Church was built on the east bank of the Cape Fear River with timber from the surrounding virgin forest.

Building of homes and planting of crops were similar but no doubt they planted more oats. Highland Scots were inordinately fond of oatmeal.

Despite hardships suffered by the pioneers establishing a "beachhead" in the North Carolina and South Carolina wildernesses, there was much that pleased them. Many had been landless in Europe, and here was abundant land for them to acquire. Everyone was free to hunt deer, turkey, and other game to supplement their food supply. Hunting in the old country had been strictly limited to the very wealthy who maintained shooting preserves.

The longleaf pine woods provided an ideal range for their livestock. There was sufficient grass during the growing season for their cattle and canebreaks along the creeks and rivers provided winter feed when frost made grass unfit to eat.

Soon they noticed that their cattle were attracted to the green grass that sprang up following fires set by the Indians. So they began to fire the woods to help locate their cattle and green up grass in the spring. Since the cattle grazed unrestricted on open range, rail fences had to be built to protect crops from them. Also, fence rows had to be kept clean and yards swept with dogwood brooms for protection from woods fires.

Hogs fed on acorns in the swamps, but they were forced to flee to the pine hills when spring floods covered the bottoms. There the hungry beasts subsisted on nutritious pine seedling roots. In later years cattlemen fires and pineywoods hogs plagued foresters managing longleaf pine.

Pioneers became superb horsemen while working cattle on the open range. At strategic locations, pens were built and cattle were driven, at least once a year, into them for branding or ear marking, castration of bull calves, and steers for butchering or sale.

Hogs were located with hounds and caught with "ketch" dogs. The ketch dogs were usually a mixture of cur and bull that had been trained expertly to fell a shoat by grabbing him by the leg or snout.

Besides cattle and hogs, the settlers raised sheep, goats, turkeys and chickens. Depradations by wild animals and hawks took a toll of them each year. Panthers and bears sometimes killed and ate calves and colts. Alligators caught unwary pigs in the swamps, and wildcats were a constant menace. Foxes and hawks boldly attacked chickens, turkeys, and guineas around farm steads.

Without cattle and hogs on the open range, life for the early settlers would have been difficult, it not impossible. In addition to beef, pork, milk, cheese, and butter, they provided many other essentials: leather for boots, shoes, saddles, harnesses, whips, and shirts; tallow for candles; and many other items for home use. Also, there was a surplus to trade for supplies that could not be produced locally: rum, molasses, sugar, salt, clothing, building supplies, tools, guns, powder, shots, flints, and the like.

The longleaf pinewoods were not only an ideal range for the settlers' livestock but also furnished heartwood that could be used to make tar and pitch. These products

were in active demand by mariners to waterproof their sails and caulk the seams of their wooden ships. Naval stores (tar and pitch) and livestock, products of the longleaf pine forests, played a major role in survival of the pioneers in the early years.

To produce naval stores, they gathered heartwood and stacked it in conical piles in specially prepared pits. The wood was then covered with sand and set on fire. Slow combustion boiled out the tar, which drained into barrels or into another clay-lined pit to be converted into pitch. Pitch and tar were collected in oaken barrels. Sometimes huge due out canoes of cypress logs were used to transport the barrels to seaport shipping points. Some of these canoes were large enough to hold 500 barrels of naval stores.

Tar has often been featured in the folkways of America. For example, as a punishment for minor crimes or other antisocial behavior, victims were tarred and feathered. The sticky black liquid was first smeared over the victims' bodies, which were then coated with gobs of feathers. To add to the discomfort, the offenders were sometimes ridden on a rail snatched from a nearby fence.

North Carolineans were dubbed "Tarheels" because of their production of naval stores. A General during the Civil War, noting the tenacity of the Carolineans facing enemy fire, wished for the "tar on their heels" to hold other troops.

William Bartram, in the latter part of the 18th Century, found that the European settlers in Carolina had not only survived the rigors of the wilderness but had established a firm foothold in the new land. He visited a Huguenot planter on Santee River who had crisscrossed his level bottomlands with dikes to grow valuable crops of rice. He enjoyed the hospitality of this man, as well as many others, who had built comfortable homes and mansions, some of brick, with large libraries and elaborately furnished. Proceeds from rice and indigo crops, as well as from large herds of cattle and naval stores operations, had made this possible.

Some settlers were engaged in timbering operations. Selected trees for spars and large logs were harvested for export. Black slaves cut the timber, skidded it to the riverbank with a big wheel rig pulled by oxen, shaped the material with a broad axe, and dumped it into the river. There, the heart pine timber was made up into rafts and floated down to the seaport for export.

At Cross Creek, trading center for the Highland Scots, Bartram found a bustling village. Enterprising settlers had built grist and sawmills, powered by water. It was a trading center for pioneers who brought cattle, naval stores, and other products for transportation to Wilmington down nearby Cape Fear River. There were many skilled people in the village: blacksmiths, coopers, carpenters, shoemakers, and the like. A comfortable tavern furnished accommodations for travelers.

Bartram's travels took him into Georgia, Florida, Alabama, and Mississippi as well as the Carolinas. In his journals, he reported that the culture developed by Carolina settlers had spread westward. Homes, farming, livestock, and timbering followed a similar pattern. He did find a difference in naval stores operations near Mobile, Alabama. Huge iron pots were used instead of clay-lined pits to convert tar to pitch.

Scotch-Irish and Huguenots had barely established permanent homes in the forested land between Santee and PeeDee rivers when their hard-won freedom was threatened. A tyrannical British government under King George III levied unfair taxes and in many other ways persecuted them -- a treatment they refused to tolerate. In bitter resentment, they left their farms and enrolled in armed forces organized by the South Carolina Continental Government to repel British forces sent to quell the rebellion against the King's authority.

Francis Marion, the famous "Swamp Fox," pursued a relentless attack against Loyalists and the British during the Revolutionary War. After the War, he played a major role in bringing peace between neighbors who had fought on opposite sides. Besides sponsoring legislation to protect the Loyalists he counseled the rugged soldiers of his brigade to forgive them. In a final muster speech he said, "God has given us the victory. Let us show our gratitude to Heaven by refraining from cruelty to man."

Since the war Francis Marion's role in keeping the Patriot cause alive while the Carolinas were dominated by the British has been widely acclaimed. For several years after the capture of Charleston his brigade was the only force against the British in the Low Country.

Marion has been honored with many place names, in poems, and in history books. Parents have proudly named their children after him. One-hundred-fifty-years afte the war, a National Forest in South Carolina was given his name during the Great Depression. The Francis Marion National Forest, which contains many acres of longleaf pine where the Swamp Fox and his men fought for freedom is a fitting memorial to them.

At the close of the Revolutionary War the great virgin forests remained largely unbroken except for a few trees cut for farmstead uses and selected large trees near streams harvested for export.

CHANGING TIMES

After the American Revolution, a new method of producing naval stores gradually replaced the pioneering process of boiling tar and pitch from heartwood collected on the forest floor. Gum was secured by tapping living trees. First a cavity was cut in the base of the tree about 10 inches above the ground with a special tool. This receptacle hacked into the truck, was designed to collect gum.

In early spring, the bark was smoothed above this cavity, called a box, and two streaks in a V-fashion were cut into the wood through the bark with a hook bladed tool called a hack. Soon gum would ooze out and flow down into the box. Then once each week new streaks were hacked above the first to keep gum flowing. In about three weeks, when boxes were full, a dipping crew came to collect the oleoresin. Using a paddle, the crew dipped the exudate into pails and lugged it to barrels on a mule-drawn wagon for transport to the still or riverside for shipment.

Tree cuts, called "faces" were worked in this manner until fall when the gum ceased flowing and crystallized on the face. A puller was then used to scrape the solid materials into pails. This last colllection was called "scrape" and was not as valuable as gum. At Wilmington, a barrel of gum brought $2.25; scrape $1.25.

At first, gum and scrape were shipped in barrels to England for distillation. About 1830, copper stills were introduced into the United States permitting local distillation.

At the still the gum was dumped into a kettle and brought to the boiling point. The vapor, when cooled, condensed into a mixture of water and turpentine. Lighter than water, the turpentine came to the top and was siphoned off. Rosin in the bottom of the still was drained, strained, and put into barrels for shipment. Value of rosin was determined by its color -- light colors being the most valuable. Dross from rosin was often used to make smudge fires to ward off mosquitoes, a troublesome pest in naval stores country most of the year.

The highly flammable naval stores were a serious fire hazard. Because of an accidental fire, an ordinance was passed that prohibited storage of them in the city of Fayetteville, North Carolina. Several years earlier, a great store of naval stores on the loading dock at the river had been set afire and destroyed by a man who pitched a match into some turpentine leaking from a barrel to see if it would burn.

In the early days most of the turpentine and rosin was produced in the Cape Fear region of North Carolina. In fact, until 1830 the gum naval stores industry had not spread south from there. There was a belief among turpentiners that longleaf pine trees would not flow gum south of the Cape Fear River. This superstition was, of course, unfounded and gum production gradually expanded throughout the longleaf pine belt. Before the Civil War, however, 90 percent of gum naval stores was produced in the two Carolinas.

Barrels of gum naval stores were generally shipped on flat boats, or timber rafts down rivers to markets. Many useful products were derived from them and the turpentiners had no trouble finding buyers.

During the 1800's, drastic changes in transportation occurred in longleaf pine country. Waterways, the highways of the early settlers, had been gradually supplemented by roads cut through the wildernesses. Often they followed Indian and buffalo trails. In the Carolinas, herds of buffalo had wintered in the coastal provinces but returned to the Appalachian Mountains for summer grazing. These migrations carved out well-marked passages through the forests and some became the route of early roads. Slow moving, canvas covered wagons traversed the one-track roads laden with merchandise. Mail and packages were delivered on horseback until stage coaches came into common use. Pioneers sometimes inserted axles through hogsheads filled with tobacco and other produce to be towed to market by slaves or mules.

When distances required overnight travel, wagoneers brought along cooking supplies, tents, and other camping equipment. They would meet others at favorite campgrounds and enjoy an evening of music and tall tales around crackling fires before bedding down for the night.

In the early 1800's, rivers still provided the primary means of long distance transportation of naval stores, timber, and similar forest products. About that time, steamboats were built. Before they came, an inventor lost a fortune attempting to power his boats on the Cape Fear River with horses operating a treadmill. Soon luxurious steamboats powered by rear-mounted paddle wheels traveled the rivers. Blasts of steam whistles announcing their arrival at landings echoed through the pineywoods.

In 1835 the first railroad in North Carolina started at Wilmington and traversed longleaf pine country through Weldon to the Virginia line.

This new method of transportation would ultimately contribute to the destruction of the virgin forests. In the early days, rails consisted of metal strapping nailed to heart-pine timbers that were set on top of crossties. But the straps would come loose and cause serious accidents and were soon replaced by iron rails moulded in a foundry. Passenger coaches were lighted with kerosene lamps and heated with stoves. Engine boilers in pine country were fired with lightwood collected from the forest.

Without spark arrestors, locomotives often set woods fires. A newspaper editor remarked with some amusement that the most valuable crop for farmers in the poor sandhills was money collected from railroad companies for damages they claimed from these fires.

Railroads had a serious effect on the trade of the city of Fayetteville. (The city, formed of two villages, Cross Creek and Campbellton, was named for the Marquis DeLafayette who visited there.) For years it had been the major trading center for farm and forest products coming from the west and for supplies needed by the backwoodsmen. But all efforts by the city fathers to get a railroad connection failed, and trade dried up when a second line was built to intersect the Wilmington-Weldon line at Goldsboro and run to Charlotte, bypassing them.

After much head scratching, a unique idea developed and was immediately acted upon. A series of plank roads were built radiating out from the city to attract trade. Plank roads drew heavily on the adjacent pine forests for material and created a temporary boom in the timber industry. First, the right-of-way was cleared and trenches were dug parallel to the route of travel. Then, 4 inch planks 4 feet long were laid in the trenches to provide a firm base for the road. On top of these planks hewn 6 inch by 8 inch stringers were placed. Across these stringers 8 inch planks 8 feet long formed the roadbed. Finally, a blanket of sand on the top completed the job.

Completion of the roads had the desired effect. Soon, loaded wagons pouring into the city and bugles announcing the arrival of stage coaches gladdened the hearts of tavern operators and merchants.

Stage coaches, drawn by teams of horses galloping in 12-mile relays on these roads, competed favorably with the slow-moving trains. Many people preferred them over the noisy, dirty, railroad coaches.

From 1858 until the advent of the Civil War, plank roads did a booming business. But they rapidly deteriorated with heavy traffic. Expansion of railroad lines, of course, sealed their doom. By the time war broke out, many of them had been abandoned. Sherman's army, however, followed a plank road in his attack on Fayetteville.

An invention of a Yankee created a revolution in the lifestyle of many inhabitants of longleaf pine country. In 1793 Eli Whitney invented a cotton gin that made growing of short staple cotton profitable. His device could accomplish as much in a day with one man as 100 people could do before.

Lured by the prospect of wealth, many entrepreneurs rushed to buy slaves and to clear land and cultivate the new crop. Many virgin stands of longleaf pine were felled to provide farmland. Soon profits from cotton permitted

Saw crews clearcut the virgin timber.

the development of large plantations. Gleaming white mansions at the end of the long tree-lined lanes hid rows of cabins in the black slaves' quarters.

The larger plantations were self sustaining with a cotton gin, blacksmith shop, grist mill, barns, and related facilities. Teams of mules and oxen powered wagons and plows; carriage horses drew surreys and buggies for the white owners. Spirited saddle horses were used for hunting and racing.

Most Southerners in the land of the longleaf pine supported the Confederacy. Many regretted that they had to fire on the flag of the country their ancestors had fought to establish. But they felt that it was necessary to defend their homeland from an unconstitutional invasion of their rights.

After the war, disheartened Confederate veterans returned to a homeland where their antebellum way of life had been destroyed forever. Suffering was most acute in Georgia and the Carolinas where Sherman had wrought his campaign to destroy the peoples' means of survival.

The dismal future that faced my grandfather when he returned from service as an officer in the Confederate army was typical. Colonel Sam John Montgomery, his father, who was too old for active service, had died during the war. The plantation was in shambles; most of his large work force of slaves were gone; livestock were butchered or driven off; buildings destroyed; and cropland was growing up in weeds.

Endowed with inbred Scotch-Irish resilience, the young veteran set out to rebuild. To obtain cash he sold, for as little as 12 cents an acre, large tracts of land he

General William T. Sherman wrought havoc through the longleaf pine belt of Georgia and the Carolinas in 1865.

had inherited. Much of it was stocked with virgin forests that speculators later sold to lumber companies. He built a substantial two story home of squared pine logs that withstood the buffeting of storms for more than a century; fields were plowed and planted in cotton.

After the war many men, discouraged by the dim prospects of their homeland, migrated west. Some of these were younger sons who had not inherited land from their parents. It was the custom at that time for all property to go to the oldest son.

Many of these migrants lived like pioneers in the virgin pine forests of Mississippi, Louisiana, and Texas. Historian Nollie Hickman described them as inhabitants of forest wildernesses with no near neighbors and desiring none. They subsisted on open range livestock, hunting, fishing, and small gardens.

Timbering in the longleaf forest provided a living for others. Over the years there had been many changes in logging and milling. Pit sawing of pioneer days had been replaced by slash saws powered by water. Circular saws came into existence in the 1850's making slash saws obsolete.

The basic task of cutting trees and squaring timbers required great endurance and exceptional skills with the axe. A day's work was from "kin til kant," from first light of day until dark. As long as the timbermen used axes, they cut stumps waist high. When the crosscut saw was introduced after the war, less timber was wasted because stumps were cut lower. At first, pine gum made the crosscut impractical but soon sawyers learned to use kerosene to dilute the gum. The kerosene kept the saw from sticking.

Steam replaced water to power the mills in the 19th Century and larger mills with greater daily production were built. These larger mills were generally located near rivers or creeks so logs could be rafted to them. Logging was done by independent operators. To move the logs to the river or stream, teams of oxen were used. The drivers were masters at getting maximum effort from their animals. They used rawhide whips to control them. In the hands of an expert teamster, the whip would crack like a bolt of lightning near the ear of a stubborn beast causing him to change his direction or urging him to greater effort.

During the "river era" oxen were used to haul logs.

The practical skidding range did not exceed 4 miles, so cutting was limited to a narrow zone along streams where water was deep enough to float logs. Logs were assembled into rafts on the rivers to be floated to the sawmill. Rafting required considerable knowledge, and logmen were subjected to many difficulties. Log jams were a constant threat; droughts and floods were special hazards. Logs could not be moved during droughts. On the other hand, floods carried the logs far back in the bottomlands where many were lost. Those that could be found had to be skidded to the stream. In addition, some of the cut trees sank and were lost.

Millmen paid loggers by the thousand board feet delivered. To separate one man's logs from another's each log had a distinctive brand that had been recorded in the local courthouse in the same manner as livestock ear marks and brands.

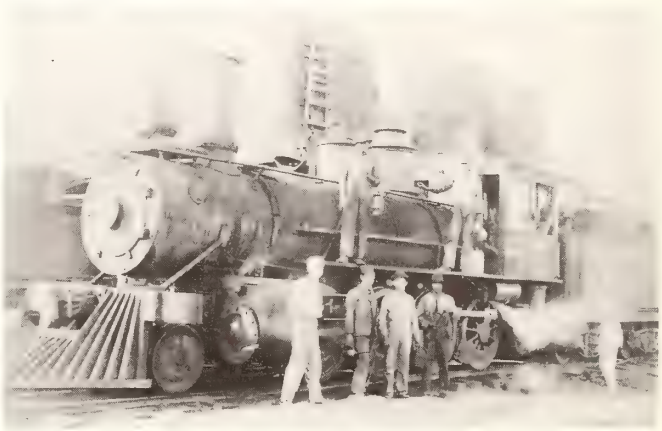
A unique method of waterlogging was conducted by Cedar Creek Lumber Company at Brewton, Alabama. Board ditches were constructed in Cedar and Murder creeks to float the logs to the mill. The ditches were boxed with a trough of heart-pine boards fastened to posts driven in the stream. At strategic locations, the creek was dammed to collect a head of water. When the pond was filled with logs, skidded there with oxen teams, the floodgate was opened, and the logs floated down the ditch.

At the mill the logs were squared to make "deals" to be exported to Europe and other markets. These deals were floated down Murder Creek to Conecuh River where they were assembled into rafts. A company man camped on the raft and piloted it to Pensacola Bay. After delivering his timber he hiked the 60 miles back to Brewton.

The river era gradually passed with the advent of railroad logging toward the end of the 19th Century. During this primitive period, longleaf pine forests had provided a livelihood for many thousands of southerners, but the impact on them was chiefly in a narrow zone near creeks and rivers. Large blocks of timber remained in the back country out of reach of timbermen.

BOOM TIMES

As the 19th Century waned, strange sounds were heard in the longleaf forest. The scream of locomotives, din of power skidders dragging logs to railroads, and the chant of track-laying crews signaled the start of a new era. Railroad lumbermen had come South in force to harvest a bonanza of yellow-pine timber.



Lumbermen moved into the longleaf pine belt in the late 1800's with locomotives, powerful skidders and loaders, to harvest a bonanza of yellow pine lumber.

The red and white pine forests of New England and the Lake States were almost cut over. Now the nation looked to the vast pine forests of the South to satisfy urgent domestic needs and a demanding export market.

The heyday of the longleaf pine timber industry was reached in the first quarter of the 20th Century. The all-time peak of yellow-pine lumber production was reached in 1909.

New logging methods were needed to reduce costs and step-up productions. To reach great blocks of timber in the back country, railroad logging was introduced. Spur lines were laid into the interior at quarter mile intervals. Slow-moving oxen teams were replaced by powerful Clyde and Lidgerwood skidders that could handle five or six huge logs at a time. Skidders greatly increased production but destroyed young timber. There was a little left following a skidder operation but a scarred landscape.

The logs were piled alongside the tracks where a McGiffert loader, straddling the rails, loaded the cars that passed underneath. Spur trucks were often carelessly built, and accidents were frequent. To keep the power movers supplied with logs, timber stands were clearcut by great throngs of saw crews. To house them and other forest workers, towns were hastily built in the longleaf pine belt. Many were shantytowns that were moved from place to place as timber stands were exhausted. Others were more permanent and some grew into modern towns and cities.

Great throngs of laborers were recruited to work in the woods and mills. Many lived in box car villages.

Groceries and other needs of their workers were generally provided by the lumbermen's commissaries. Often they paid the workers with script that could only be cashed at these establishments.

Huge band mills were erected that could cut over 100,000 board feet in a single 8-hour shift. The first all-steel mill was built by Great Southern Lumber Company at Bogalusa, Louisiana.

Often turpentiners worked the trees before they were cut by the timbermen. At first, lumbermen believed that the turpentine face would weaken the timber, but this was disproved by Bernard E. Fernow in 1893. The early "chop box" method of collecting gum did waste a lot of good material; especially where faces had been burned.

But around the end of the 19th Century, W.W. Ashe and Charles H. Herty were successful in developing more conservative methods. The new system employed shallow chipping and a cup and gutter replaced the destructive box. At first, clay cups were used, but later metal cups and gutters became popular. Use of the cup and gutter system achieved widespread use after 1910.

Clay cups replaced the distructive "chop boxes" for turpentining in the early 1900's.

To protect turpentine faces from fire, operators raked a cleared strip around each tree and control burned the area. These fires destroyed many newly germinated seedlings because the block was usually burned annually. Sometimes there was a delay in burning, and a new crop of pines were established if the previous burn had happened to come before a good seed crop.

Naval stores laborers lived in camps provided by their employers. Groceries, work clothes, and other supplies were furnished at a commissary. Workers developed special skills, depending on their ambition and talents. Recruitment of labor was a special problem and each operator was alert to preventing "pirating" of his workers by others. Sometimes an unscrupulous turpentiner would send some of his men into another camp to lure laborers away. This was a dangerous business and the recruiter sometimes paid with his life for this practice.

In 1914, World War I broke out in Europe. Most Americans were not greatly concerned until German submarines sank the Lusitania drowning many of their countrymen. President Woodrow Wilson was reelected in 1916 promising to keep the nation out of war and the nation hoped he would be successful.

Since 1914, when the war started in Europe, German submarine warfare had dried up export markets for southern pine lumber. In 1917, the situation was changed drastically. Carloads of lumber were needed for wooden barracks to house soldiers and additional lumber was required for railroad cars.

Also, there was an urgent demand to construct 1,000 wooden ships. Southern lumbermen assured the nation that they would furnish timber needed to win the war. W.H. Sullivan of Great Southern Lumber Company predicted that enough timber could be produced from the virgin longleaf pine forests of the South to turn out 20 to 30 vessels a day from southern shipyards.

But the lumbermen faced many problems with the ship building program. A great number of timber, 12" x 12" x 24', were needed. Wood-cut lumber did not furnish enough of that material, and suitable trees had to be hunted out, which reduced overall production. Changes in ship design created other problems. Drafting of men for the armed services and migration of workers to other war jobs caused labor shortages.

During World War I huge longleaf pine trees were cut to build a fleet of wooden ships.

Despite all the difficulties many wooden ships were built until the demand slackened in late 1918 when steel became available for ship construction.

In the skurry and bustle of the time, little thought was given to growing a second crop of trees. Most lumbermen considered regeneration highly impractical, and, indeed, local tax policies encouraged them to "cut out and get out."

But there were a few, encouraged by pioneering foresters like Austin Carey, who braved the scorn of their fellows and made some provision for a second crop. In Alabama, the Alger Sullivan Company, T.R. Miller Mill Company, and Kaul Lumber Company were early converts to conservation.

In 1905, at the request of Kaul Lumber Company the USDA Forest Service prepared a management plan calling for modification of cutting practices and fire protection. It was approved by the nation's chief forester, Gifford Pinchot.

Louisiana's Henry E. Hardnter, known as the "Father of Forestry in the South," cooperated with Herman H. Chapman of Yale University to find ways to regenerate longleaf pine. At Bogalusa, Louisiana, Red Bateman, chief ranger with Great Southern Lumber Company, designed a dibble, still used by many, and planted some 20,000 acres of longleaf seedlings he grew locally. In 1920 Austin Carey, noting a good longleaf pine cone crop, suggested that Bateman burn the seedbed to prepare for a catch. His suggestion was taken and several thousand acres were seeded naturally. Bateman arranged that the company fence the area to protect the seedlings from hogs and keep fire out of them. When the virgin overstory was logged, the seedlings survived and the area did not have to be planted.

Henry E. Hardtner, known as "The Father of Forestry in the South," cooperated with Professor H.H. Chapman of Yale University to find ways to regenerate longleaf pine.

There were others like Posey Howell of Dantzler Lumber Company in Mississippi and Goodrich Jones in Texas who made an effort to get a second crop of longleaf, but the virgin forest generally was considered a nonrenewable resource to be mined like iron ore.

The railroad loggers swept across the longleaf belt from east to west. Intensity of cut increased with the westward movement, reaching a crescendo in Louisiana. Few trees escaped the battering of the skidders. By 1930, it became apparent that the end was near. Only

By the late 1920's most of the "railroad loggers" had to cut out leaving a bare and desolate land (Kisatchie National Forest).

a few tracts of the 60,000,000 acre virgin forest remained. Many lumberman closed down their mills and moved to the West Coast to log virgin stands of Douglas-fir, ponderosa pine, and redwood. The finest hour of the longleaf had come to a close. Shocked silence replaced the din that had greeted the dawn of the 20th Century. Four decades of feverish activity had ground to a halt.

THE GREAT DEPRESSION

The Great Depression that plagued the nation in the Thirties plumbed unusual depths in the land of the longleaf pine. Most of the big mills had cut out and many operators had moved on. Banks and businesses dependent on them failed. Tax revenues for local governments dried up. Ghost towns were tragic reminders of better days. The landscape had drastically changed. Cool, green shadows of the virgin forest were only memories, and no longer did the resinous breezes sing through the tufted tree crowns. Instead the refuse of logging lay bleaching in the sun on millions of acres. Except for stumps and an occasional "mule tail" pine the bare land was reminiscent of the western plains.

Scrawny cattle picked at the coarse grass and razorback hogs rooted out the remaining seedlings. Buzzards circled overhead and frequently feasted on the carcass of a cow that had succumbed to the twin hazards of ticks and starvation.

Suffering was most acute among forest workers left behind when the mills left. Many stayed on tax-delinquent company lands and scratched out a bare existence with small garden patches, submarginal farms and scrub livestock. Hard cash for medical service or other emergencies was nonexistent. Stunned and despondent, the people of the longleaf belt faced a grim future.

I spent the early days of the Depression as a forestry student at North Carolina State, enrolling as a freshman in 1929; the year the stock market crashed. After earning a degree in Forestry in 1933 and working almost two years in the Southern Appalachian I was transferred to the Kisatchie National Forest in Louisiana. The cutover land was not as attractive as the luxuriant hardwood forests and clear streams of the mountains, but the opportunity to work in longleaf pine was especially appealing to me.

My first winter there I supervised CCC enrollees planting some 2 million longleaf and slash pine seedlings in a bare "stump orchard" protected by a fence from razorbacks. Before planting began we were trained at the Stuart Nursery by nurseryman Arthur Reed and Phillip Wakely of the Southern Forest Experiment Station. The Nursery, largest in the South, was named for Chief Forester Stuart, who had been killed in a tragic accident in 1933.

On the last day of the training school Reed designated one junior forester to head up planting at each CCC

camp. With two junior foresters to assist me, I was put in charge of planting at Provencal camp near Natchitoches.

Superintendent Cagle assigned about seven 20-man crews to us: each with a foreman, tree tender, and 18 planters. After a few days of intensive training, production per crew began to average over 5,000 trees per day -- good compared with that of other camps. Later a staff man from the Supervisor's office came out and we worked with him to develop a more efficient crew organization that considerably stepped up production. We found that one man handling both dibble and planting tray was much better than the two-man units we were using.

Civilian Conservation Corps crews replanted some of the cutover land.

By March we finished our assigned quota having planted seedlings on some 2,000 acres of bare cutover land. They would grow into a productive forest to support future generations.

After the planting season, I got exciting news from the supervisor. The Forest Service was in the process of buying 125,000 acres from Bodcaw Lumber Company in Winn and Natchitoches parishes. This land, along with some smaller purchases, would be organized into a new ranger district. A new ranger would be appointed and I was considered a prime candidate. To groom me for the job he had arranged attendance at a ranger school to be held in Mississippi by Supervisor Raymond Conarro and his assistant, Joe Riebold.

After a week of training at Gulfport we enjoyed a delightful "quail on toast" supper at a CCC camp near Wiggins. Surrounding the camp was a great cutover area so flat that you could see a cow for over a mile. Little did we suspect that millions of longleaf pine seedlings were hidden in the grass and would grow there into fully stocked second growth stands on the the DeSoto National Forest.

After the school I was assigned to a job on the new purchase unit that gave me valuable knowledge of forest conditions, management problems, and above all, contacts with the people in the area.

My work was officially known as an "occupancy survey." Before government lawyers could complete the Bodcaw sale a Forest Service official had to thoroughly examine the property and map any buildings, fences, or other improvements owned by people who might claim title to the land. Where improvements were found the owner was asked to sign an application for a special-use permit. If he did, this was evidence that he did not claim title. Each application had to be accompanied by a map, which I prepared with a plane table.

To help find the land and people, I arranged for George Cunningham, a retired company land agent, and local man stationed at the camp, to help. During the next 3 months, we found 175 cases of occupancy, mostly by unemployed company workers who had either "squatted" on the land or fenced company property next to their small farms. Only one man refused to sign for the permit and decided to claim title. Everyone treated us courteously. Many invited us in for dinner and we accepted provided they would share our GI sandwiches that I did not consider as tasty as their home-cooked food.

But there was a deep-seated undercurrent of resentment and apprehension. Often they spoke of the shock of losing their timber jobs and many felt that the company was to blame for their predicament. Also, there was fear that the Federal government would make them move. They were somewhat relieved when I told them they could probably stay by signing for a special-use permit. But a nagging fear still remained. Open-range cattle and hogs were important to their livelihood. Could they still graze government land unmolested?

Every spring for years they had burned the range to green up the grass. Would this be permitted? The company had been very lenient about them cutting firewood and "board" trees for buildings. They even looked the other way when crossties and ash logs were cut for sale. There were rumors that no cutting would be permitted on government land--even for firewood.

Almost everyone was an admirer of Huey Long, the Kingfisher, who was a native of Winn Parish. They were looking forward to his election next year bringing a better life with his "Share the Wealth" program. In 1932 Long had supported Roosevelt, but then he had fallen out with the administration and vowed "to eat any trees planted by the CCC." To the people, the Forest Service represented their political enemy--Roosevelt.

A widow, living in a small clearing on a scrub oak ridge near Saline Bayou, was typical of the plight many suffered. Her dwelling would have been considered poor shelter for a mule. It was framed with scrub oak poles; sided and roofed with boards rived from a pine tree, over a dirt floor. Inside, the furnishings were even more pitiful. There was an ancient stove, a rusty iron bed with a corn shuck mattress and a wobbly table covered with worn oilcloth. On a few board shelves were some rusty cups, tin plates and other utensils; also a scant supply of food; mostly meal, fatback and coffee. The most important feature of the interior was a large campaign poster showing the smiling face of the Kingfisher.

When we drove up, she was hoeing vegetables in a small garden patch. Courteously, she brewed coffee for us, after wiping out the cups with a greasy rag, and helped us make a survey of her improvements. Besides the shack, there were fences around the garden patch and a small cornfield, and a well. She readily signed the application for special use.

Our most perplexing case of occupancy was in 3,000 acres, devastated by a skidder operation, known as the Chandler Camp. In the center of the clearing there was

a haphazard collection of boxcar shacks that housed a dozen or so unemployed forest workers and their families. There were no large fields but several garden patches. A herd of goats grazed on the coarse grass and some chickens scratched in the bare yards, bleaching in the sun.

Obviously, the clearing would have to be fenced, livestock and families removed, and trees planted. We called a meeting of the men to discuss the situation. Our announcement created a cloud of gloom and despondency as well as anger. But no one claimed title to the land and all signed up, hoping that some way they would be able to stay. Later, arrangements were made with the Resettlement Administration to find homes elsewhere for them.

Forest conditions were unexpectedly favorable on the Winn unit. In the early years, Bodcaw Lumber Company had cut conservatively leaving a fair stand of young timber. In many places there were enough longleaf pine seed trees for natural regeneration, and some well-stocked second growth that would soon support a sale. In the last few years, however, they decided to clearcut and close the mill. This operation left two large tracts, Chandler Camp and Gum Springs, that would have to be fenced and planted.

When I submitted the signed occupancy statement I got startling news. There was a new supervisor in Alexandria, and George Tannehill would be the new ranger. I would remain on the Winn District as his assistant.

From the first I got along well with George. His father, an official with the Urania Lumber Company, had been our host on my 1933 trip with the North Carolina State seniors. We had similar backgrounds and knowledge of forestry problems and people.

A few days later we received tragic news. Henry Hardtner, president of Urania Lumber Company, had been killed in an accident at a railroad crossing south of Winnfield. George and I attended the funeral and helped dig Hardtner's grave.

Tannehill valued the knowledge I had gained during the occupancy survey of the people, and management problems. I took him to meet many of the people, and we spent several days driving together over the district, discussing the situation, and making plans. But there was not much time for planning. Two CCC Camps had been established, Calvin and Chestnut, and we had to take the lead in formulating work projects for them.

A first priority was to perfect our fire protection organization. We constructed two temporary lookout points and a steel tower. In north Winn Parish, one crew built a wooden cabin of rived pine boards on a high hill known as Eagle Mountain. Within the Chandler Camp area, another crew built a lookout cabin set on pine poles cut from the forest, on a high point known as Bandit Hill. The steel tower, along with Gum Springs tower, which had already been built, completed our detection system. Next we selected the tower men and trained them and the fire-suppression crews. A dwelling was built at the steel tower and a man was permanently stationed there.

In the midst of the flurry of construction, Huey Long was assassinated in the capitol building in Baton Rouge. Death of the Kingfisher hardened the local people against the Forest Service and made more difficult our relations with them.

In September 1935, soon after the death of Long, we noted a bumper crop of cones on longleaf pine seed trees. Stuart nursery had been "crying for cones," so I organized a CCC crew to collect them. Local fishermen used white cedar poles to fish for buffalo (carp) fish. These poles were surprisingly light and strong so I secured a few of them and bolted a strap metal hook at each end. My climbers used them to dislodge the ripe cones for others on the ground to collect. We harvested and sent several dump truck loads to the nursery. Tannehill suggested that we scalp grass from the seedbed under seed trees near Gum Springs tower to see if it would increase the catch of seedlings. We found that it did.

Junior foresters at the CCC camps supervised planting of the two clearcut areas that winter. I helped train and organize the crews but could spend very little time with them. My main activity was investigating unauthorized cutting. Fortunately, we were able to issue free use-permits to local residents for firewood but cutting of merchantable trees for crossties and ash logs for sale had to be stopped. At the time, ash logs delivered to Shreveport were bringing the unbelievable price of $50.00 per 1,000. Cutters were diligently searching the forest for them.

To spot unauthorized cutting, we scouted the district for haul roads. One clever culprit, knowing this, tried to hide his road by skidding his crossties down the railroad track with a mule to Coldwater siding. Fortunately, I happened to find his logged area while scouting for a land corner. I cut several sections from stumps, compared them with the ties that had not been taken up, and found the name of the seller from the agent. When Tannehill and I confronted the thief with our evidence, he readily accepted the option of paying penalty stumpage to avoid a Federal case.

We had been told that the ash loggers were working at night so I spent several cold nights trying to catch them. Apparently we had been misinformed, and they were logging in the daytime. So we staked out the cutting in the daytime and, luckily, caught them loading logs. Unfortunately, we were not able to prosecute because the title for the land where they were cutting had not been cleared from Bodcaw Lumber Company. We were able, however, to get the company to deduct the value of the logs from the land price.

With strict law enforcement, we were gradually able to reduce the loss of timber to thieves. Stopping of wildfire, deliberately set, was another problem that plagued us. We were caught between the proverbial "rock and a hard place." Forest Service policy at the time was strict exclusion of fire from longleaf woods, except for a trail of prescribed burning approved for another district.

Moreover, our cattlemen friends pointed out the value of greening up the grass for their cattle and the lack of damage to the longleaf forest. Too, some wanted a small burn near dripping vats where they periodically had to treat their cattle for Texas fever ticks. The green grass on the burn would attract the open range cattle making them easier to catch. But we had to deny all their requests for burns. This made them angry and some tried to set fires anyway.

But our fire problem was much lighter than other districts, especially where foresters had sheep men to

deal with. We averaged only about 30 fires a year, usually small, because we had good detection and well trained CCC crews. On southern districts fire occurrence ran into hundreds of big fires.

We did have one grudge fire set by an old man to spite the CCC enrollees. Luckily, a survey crew caught him in the act of throwing down lighted matches while they were sitting in the grass eating lunch. George and I spotted the smoke from Eagle Mountain lookout. When we arrived the CCC men were sitting on the old man. They had beaten him because he threatened them with a knife when they ran him down. George took him to town for treatment and arrest by the U.S. marshal. Because of his age the judge gave him a two year suspended sentence.

Fire suppression, investigating timber trespass, planting and the other activities kept me busy, often seven days a week. After the junior foresters finished planting I organized them into a timber survey crew to collect data for a mangement plan.

FOREST FIRE HERESY

Regarding forest management, a pitched battle between people advocating use of a controlled fire in the longleaf pine forests and those opposed reached a climax during the thirties.

Beginning with the first settlers, annual burning of the woods had become a firmly established practice in the Southland. Cattlemen used fire to green up the grass and help control movement of open range cattle. Turpentiners raked straw from around faced trees and control the burned area to protect them from accidental fires. Hunters drove game with fire and collectors of lightwood swinged off the grass to make the wood easier to find. There were numerous other reasons for burning: to open up the woods making travel easier; to kill snakes and ticks; and just "for the hell of it." Coming of spring always meant smoke in the pineywoods.

Besides the local residents, there were others who supported a desirable role for fire in the longleaf woods. As early as 1850, Charles Lyell, a British scientist and traveller, noted that the hills near Tuscaloosa, Alabama, were covered with pine seedlings. He speculated that they resulted from Indian-set fires that kept hardwoods under control and favored longleaf pine.

In 1908 Herman H. Chapman, a Yale professor, explored longleaf forests on Kaul Company lands in Alabama. From his observations he concluded that fire was beneficial to the forests.

The bitter battle between the fire exclusionists and control burners was won by the burners in the 1930's. Afterwards prescribed burning became standard practice.

Roland Harper, an Alabama naturalist, wrote several articles between 1911 and 1914 pointing out the beneficial role of fire in setting back hardwood succession and allowing the fire-resistant longleaf to survive. He speculated that lightning kept the woods burned before the Indians came with the hunting fires.

In addition to these men's there were other people who noted longleaf pine's ability to withstand fire damage and saw a possible beneficial role for fire. Professional foresters, mostly from the North, were shocked at the widespread occurrence of forest fires in the South. Influenced by disasterous crown fires in Minnesota, Michigan, and the West, they had a morbid fear of all forest fires. To them, the first essential of forestry was exclusion of fire from the woods. They were dismayed by Southerners who considered woods burning normal, like the coming of spring, and believed that controlled fires did some good.

So these forests mounted a vigorous campaign aimed at the forest fires. Their missionary work was slow and discouraging but gradually some progress was made. State forestry departments, with the primary objective of controlling forest fires, began to emerge. Laws against setting fire in the woods, although weak and largely ignored, were passed. Crows nest lookouts to detect fire were mounted in the tops of trees and sometime on other high points such as silos. Fire wardens were hired and equipped with primitive tools to suppress fires. Speeches were made asking for fire prevention, and signs were posted.

It was an uphill battle because the public was generally against them. Often their best friends were conservation-minded lumbermen like Henry Hardnter, who did recognize some value for fire, but was vigorously opposed to wildfire.

The stage was set for a battle between the fire exclusionists and advocates of controlled fire. It was joined in the longleaf pine forests where the woods burners had the strongest case for the use of fire. Herman Chapman, a strong advocate of prescribed burning, stirred up a great controversy within the forestry profession by proclaiming benefits for fire. With the cooperation of Henry Hardnter, he had investigated the possibility of naturally regenerating longleaf pine. Using Yale forestry students as assistants, Chapman's studies were conducted on Urania Lumber Company lands in north Louisiana for several years.

In 1926 he published a bulletin on his findings. He strongly advocated several ways fire could be used beneficially. When a good cone crop appears, he recommended burning in summer before seedfall in October. Such burning, he said, would remove grass and pine needles and allow the seed to reach mineral soil. His research plots supported this, for he found more seedlings on those that were burned. He also speculated that hardwood invasion could be suppressed; that a dangerous buildup of fuel in unburned areas could be reduced; and that fire might help control brownspot, a fungus disease especially damaging to longleaf seedlings.

Sustained by his research, Chapman mercilessly condemned the foot dragging of more conservative foresters, especially state foresters and the Washington Office of the Forest Service.

Another activist on the side of the burners was S.W. Greene, an employee of the Bureau of Animal Industry. On a grazing study he conducted on the McNeil Tract, DeSoto National Forest, he found that cattle gained more weight on burned than on unburned pastures. His findings were embarassing to foresters who contended that burning damaged the range. Because of the radical nature of his findings, he was not able to get approval from USDA officials for publication for several years. Frustrated, he bitterly condemned the fire exclusionists. After some delay he was able to get an article published in *American Forests* magazine.

Herbert Stoddard, a recognized authority on quail management, also preached a gospel of woods burning to benefit these upland game birds.

Not all foresters were fire exclusionists. Two respected members of the Forest Service added support to the burners. "Cap" Eldredge, a native southerner and first supervisor of the Choctawhatchie National Forest in Florida, advocated the use of fire for hazard reduction, especially where the fire-control organization was weak.

Austin Carey, widely respected for his knowledge of southern forestry and the people, was converted to the use of fire in longleaf pine forests. Of course, he strongly advocated prevention and control of wildfire.

B.W. Wells, an ecology professor at North Carolina State, agreed with Roland Harper that longleaf pine was a fire subclimax type dependent on fire for its existence.

Fire exclusionists were horrified by the turn of events. They deplored statements in favor of fire by respected foresters and scientists. These opponents of any fire in the forest felt that this division in the ranks was doing untold damage to forestry. So they redoubled their fire prevention efforts.

Caught up in the fever of the battle, some people greatly exaggerated the damage from fire. One forester proclaimed that fires were killing large virgin longleaf pine, which cluttered up the woods and made travel difficult. This view was directly opposed to the contention of burners that fire had created the open parklike woods of valuable timber immune to fire damage.

To promote fire prevention, the Forest Service hired H.N. Wheeler to make a series of lectures in the South. Son of a minister, he had been a ranger on a national forest in California. Wheeler blasted away with "Billie Sunday" type lectures aimed to promote strong emotions against woods burners. Even Forest Service officials, opposed to control burning, were somewhat embarrassed by the forcefulness of his remarks.

Another major campaign against the menace of forest fires was begun in 1927. Dixie Crusaders, a select company of uniformed foresters, toured the south with an intensive fire prevention message. Using movies, talks, and other types of publicity they were extremely effective. The young men visited schools, country churches, anywhere they could assemble an audience. Many people were educated to despite woods burning. One newspaper editor, influenced by fire prevention messages, condemned as unpatriotic those who would prescribe fire in the forest.

State foresters were solidly opposed to controlled burning. They felt that publicity on beneficial uses of fire would be misunderstood and undercut their fire prevention efforts. Heading their opposition was Page Bunker, State Forester of Alabama. He poked fun at the theory that lightning and Indian fires helped create the virgin forests. In his opinion, fire was an unmitigated evil.

Goaded into action by Chapman and others, E.L. Demmon, director of the Southern Forest Experiment Station, began research on use of fire in longleaf pine forests. Many of the studies were conducted on three experimental forests that he organized: Harrison on the DeSoto National Forest in Mississippi, Olustee on the Osceola National Forest in Florida, and Palustris on the Kisatchie National Forest in Louisiana. Work was also done on other areas.

Findings by the researchers swung the battle in favor of the controlled burning. After a comprehensive study of brownspot, P.V. Siggers published an article in the *Journal of Forestry* in 1932 confirming Chapman's opinion that fire could be used to control the disease.

Heyward and Barnett found that control burning could be done without serious damage to soil. In fact, it was slightly beneficial to the minerals in the soil. Other studies explored the damage of fire to seedlings and trees; effect on the range; seedbed burning benefits; and other fire relationships. Research supported the contention that properly controlled fire could be used as a helpful management tool in longleaf pine forests.

In 1932 a disastrous 12,000 acre fire on the Osceola swung many foresters over to hazard-reduction burns.

As President of the Society of American Foresters, Chapman arranged the 1935 annual meeting at Lake City, Florida. The topic was "Southern Forest Fires." Emphasis was on the possible desirable use of fire in longleaf forests. Speakers were Demmon, Greene, Stoddard, Hardtner, Wahlenberg, and Eldredge.

It was the consensus of those attending that fire was a useful tool for management of longleaf forests but publicity should be handled carefully. Wildfire prevention and control were still vital for southern forestry.

After the meeting, the Forest Service decided to permit administrative tests of prescribed burning on national forests in the longleaf type. Arthur Hartman burned about 900 acres in the Red Dirt Pasture, Kisatchie National Forest, to prepare the seedbed for the bumper 1935 crop. Results were very good.

Supervisor L.L. Bishop put in two burns that year in Texas and burning was also done by Raymond Conarro in Mississippi. He was the originator of the term "prescribed burning."

Some state foresters began to advocate the planned use of fire and many other people found that it was a powerful management tool if carefully applied. The practice spread to other forest types from its beginning in the longleaf forest. Acceptance of prescribed burning was a significant milepost in the longleaf pine story that argued well for the species. Lack of fire, perhaps more destructive than fire, had prevented the establishment of seedlings by the invasion of brush and other pines less resistant to fire.

THE SECOND FOREST

Like the fabled Phoenix bird, a second forest sprung from the ashes of the virgin timber. It covered only about a third of the original acreage, about 20,000 acres according to the forest survey of the 1930's. Often the stands were poorly stocked and sometimes nothing but scattered "mule tail" pines overlooking a wilderness of grass and stumps. A lot of the land had been converted to crops or other uses. Also, hardwoods, other pine species, and razorback hogs had prevented regeneration of longleaf pine on millions of acres.

The second growth forest was a far cry from the virgin forest, and logging technology had to be changed. At first pulpwood was loaded by hand and mule teams crosshauled logs on trucks.

Before the advent of man, the virgin forest had held its own by natural processes. Openings caused by lightning or bugs were small and healed rapidly by seed from nearby mother trees. When hurricanes crashed ashore, ripping gaps through the forest, they were rapidly healed in like manner, or by seedlings that had already been established under the virgin trees.

Indians made little inroad on the virgin acreage, nor did the early pioneers. Destruction of the magnificent virgin forest was done during the railroad era when most loggers clearcut without any provision for the future.

Despite man, millions of seedlings emerged from the grass and grew into merchantable stands. How did this happen? Many seedlings were accidently established when cattlemen, hunter, or turpentiner fires happended to come just before a good cone crop. If the area was not reburned for a year or so, the seedlings survived future fires. These seedlings, stored under the sheltering tree crowns of the virgin timber, grew to occupy the site when the old trees were felled in a hurricane or were clearcut by loggers. In south Alabama, many excellent second-growth stands originated in this way after hurricanes. On the DeSoto Forest in Mississippi good stands came from seedlings stored in the understory when the loggers swept through clearcutting every merchantable tree.

Although few and far between, some second growth stands were the result of deliberate action by people. An excellent example was the longleaf pine stand established naturally on Great Southern Lumber Company lands in Louisiana. These came from a seedbed burn prescribed by Austin Carey before the bumper 1920 cone crop. Subsequent protection of established seedlings from hogs and fire, and clearcutting of the virgin timber released the advance reproduction.

Prescribed burning on national forests before the 1935 crop established several thousand acres of seedling stands on the Red Dirt Pasture in Louisiana, the Boykin Springs area in Texas, and others in Mississippi.

In the thirties, many barren blocks were planted by CCC crews. Scattered here and there across the South a few successful plantations were established by others.

T.R. Miller Mill Company and Kaul Lumber Company in Alabama, Urania in Louisiana, and other lumber companies made an effort to protect young trees when the original timber was cut. Some of these grew into merchantable second-growth forests.

Demise of the virgin forest left most second-growth stands generally understocked and fragmented into smaller tracts, a far cry from the massive thousand acre blocks of prime timber that greeted the railroad loggers. The powerful skidders, loaders, and locomotives were gone by the Thirties along with most of the big double-band mills. Organizations of skilled loggers and mill men had been disbanded. Company commissaries were no longer needed.

Slowly a new technology was developed adapted to harvesting the second-growth forests. Notably, the rubber-tired logging truck replaced the steel tracks and logging locomotives. Small skidders like the "loggers dream" replaced the Clyde. They were used to extract one small log at a time from narror branch bottoms that penetrated the longleaf woods.

Later, logs and pulpwood were loaded with power equipment.

Mule teams skidded logs to "landings" and cross hauled them onto short body trucks. Pulpwood was usually loaded by hand on "bobtail" trucks.

Until World War II most logs were cut with crosscut saws. Gradually chain saws were introduced and replaced later by tree shears. Pulpwood was cut with crosscut and bow saws. Later, crews used a circular saw mounted on bicycle wheels and powered by a small gasoline motor. Pulpwood was also harvested by a machine that cut and bundled the wood.

Some logs were trucked to the stationary mills to be sawn. At first, however, much of the lumber was produced in the woods by portable "peckerwood" mills that moved from place to place leaving piles of sawdust in their wake. Rough green lumber from these little mills was hauled by truck to central concentration yards where it was stacked in triangular piles for drying. After drying it was dressed in the planer mill for shipment by rail or to be sold to local markets. Presently, most logs and pulpwood are cut tree length and hauled to central stationary mills. Rubber tired skidders, compatible with selective logging, have replaced mules.

Despite the radical change in technology, lumbering in the second forest still provided a living for many southern people. In many cases, the forest workers are also part time farmers living on small subsistance farms.

Turpentiners moved into the second forest without much change in technology. It was still labor-intensive, and operators continued to supply their workers with a commissary. As long as there was virgin timber, most gum naval stores were produced in longleaf pine forests. Operations in second-growth forests have almost disappeared from longleaf woods and are not centered in the slash pine of southern Georgia and northeastern Florida.

The last contribution of the virgin longleaf pine forests to the economy are stumps that are pulled from the ground and are hauled to plants that extract rosin and turpentine from them.

Open range ranzing has gradually disappeared from the second growth longleaf pine forests. Where grazing is permitted, it is coordinated with timber growing.

WORLD WAR II

With the beginning of World War II, I returned to South Carolina to work for a few months in the land of the longleaf pine. As district forester I was located at Aiken, a resort city located at the edge of the fall line sandhills.

Many people, including Gary Cooper the actor, came there to enjoy polo and fox hunting. Fox hunters, mounted on spirited horses, galloped through the pineywoods behind their hounds.

My district included seven counties, but only four had organized fire protection. In the organized counties there was a ranger, four wardens, several lookouts, and a fire crew for each warden. Also, each warden had several "retainer fee" crews. There were selected key men in each community who were paid a small annual wage mainly as a fire prevention measure.

We had steel lookout towers hooked up with telephone lines to the ranger's offices. There were no shortwave radios or fire plows. Crews were equipped with council tools, flaps, and backpack pumps for fire suppression.

Fire prevention and control were given high priority because of the war. Ther were many ways that wildfire could impede or seriously affect defense operations. For example, a large fire threatened the ammunition dump at Columbia Airbase. It was more than our organization could handle, so we had to call on the military to send soldiers to reinforce us. With several hundred of them under our supervision, we were able to stop the march of the flames before serious damage was done.

A crown fire jumped the U.S. highway south of Aiken and threatened homes that had been built in the surburban woods. Fortunately, a woods road ran perpendicular to the path of the flames and our backfire along this road stopped the spread.

Our skeleton organization was busy controlling wildfire that popped up, and we kept a sharp eye out for firebugs.

Our major contribution to the war effort was an intensive timber management program. For a fee, we marked and cruised forests for landowners, computed the volume and value, and helped them with the sale of timber needed by the armed forces.

When I began work, a boycott by local lumbermen of State-marked timber was a major problem. We had several tracts already marked that could not be sold, and landowners were refusing to sign up for our assistance. Our efforts to stimulate production of wood products were blocked. To overcome the boycott, I managed to get buyers from companies in Goergia to bid on several tracts containing material ordered by the military. After this, local buyers resumed bidding.

Although there were many poorly stocked longleaf forests on my district, some were as good as those found anywhere in the South. On the Hitchcock Estate, I measured plots that contained 43,000 of prime timber board feet per acre.

Forest products were critically needed by the armed forces for ammunition boxes, crating, dunnage and for many other purposes. As a district officer employed by the Forest Service on the Timber Production War Project, it was my responsibility to help lumbermen, pulpwooders, and naval stores operators with their production problems. My territory covered the southwest part of Alabama.

In southwest Alabama most sawmills were large but there were a few peckerwoods mills. Power units on small mills were usually inadequate, and much time was lost as the sawyer gingerly had to feed the log into the saw to prevent the motor from choking down. A specialist from the Forest Products Laboratory had given us special training in finding and correcting small mill problems.

Usually the RPM on the saw was too fast for the carriage feed rate and the RPM on the power unit was too slow to build up enough horse power. I analyzed several mills, changing saw and power unit mandrels to the proper size. Operators were delighted with results often reporting a 25 percent increase in production.

Another attempt to increase forest product output did not turn out so well. Joe Brady, a Birmingham industrialist, contacted me and proposed that we conduct demonstrations to promote use of chain saws. He predicted that the usual quota fo 50 logs per day for crosscut saw crews could be quadrupled.

Fortunately, I had assigned to me a technician who was skilled in use of chain saws. He was also a master mechanic. We conducted a series of demonstrations over the district that confirmed Brady's prediction. Lumbermen were delighted, and many purchased saws. But the saws were heavy, weighed over 100 pounds, requiring two operators, and suffered frequent breakdowns. Parts were hard to get. Production with untrained crews was far below what my technician and I had demonstrated.

We tried to help train crews, and I almost got killed when a "widow maker" struck my shoulder while felling a large pine. Many discouraged lumbermen gave up and returned to crosscut saws. Edward A. Haus, president of Alger Sullivan Lumber Company said, "Anyone smart enough to use that contraption is too smart to work in the woods."

But many of our projects aimed to stimulate production were successful. Where operators were short of stumpage, we marked, cruised, and helped sell key tracts for them to cut. Assistance in procuring tires, gasoline, trucks, parts, and other scarce items was appreciated. Once a lumberman in Choctaw County, Alabama, complained that his workers could not get enough meat to sustain them on the job because a bureaucrat would not issue permits to kill hogs. This was remedied. We helped train German prisoners of war for woods work and tackled the many other problems holding up production of critical war material.

Toward the end of the war an official with International Paper Company asked me to help on a wood supply problem. There was a large block of timber in Baldwin County, near the Forst Mims site where Red Eagle had massacred whites over a century earlier. The tract was inaccessible to rail traffic and too far for truck haul to Mobile. Wood could be brought economically down Tensas River to the city by barge if a channel could be dredged to Boatyard Lake Landing.

Together we contacted the Army Engineers and found that they had equipment to do the job but would need approval from Washington. To get approval, we made a survey of the channel, estimated the cost of dredging and got signed statements from landowners agreeing to sell timber and loggers who would cut the wood. All of this was combined in a report and sent to Washington.

After much delay, approval came back but it was too late. The dredging equipment had been moved and was no longer available to do the job.

On April 12, 1945, President Roosevelt died of a stroke. Symbolically, he died at Warm Springs, Georgia, in the South where his conservation policies had done so much for forestry. His CCC boys had planted thousands of acres of cutover land with pine, several new national forests were established, and old ones expanded in the longleaf pine belt.

POST WAR PARADOX

In January 1946, W.G. Wahlenberg published his masterful longleaf pine monograph. It documented practically everything that had been written on the species for 40 years. Coverage was comprehensive including the longleaf problem, resources, uses, properties, ecology, fire relationships, protection, and management.

Dedicated to a future for longleaf pine, the book, with its comprehensive documentation of published material and a scholarly evaluation by the author, was hailed by Raymond Pack and H.S. Graves, as a significant boost for the management of the species. In a more subdued note, Wahlenberg described it as being useful to many people but ponted out gaps in knowledge requiring more research. He recommended a major revision in two or three decades because much of the material was based on virgin stands whereas the need was for management of second growth stands.

The author began by summarizing the longleaf pine problem: the reduction in forest acreage, years of mismanagement, encroachment by other species, inherent limitations of longleaf as well as its attributes.

In the "Resources" section, he estimated that the acreage in the second gorwth forest was only a third of the original. At the time of his monograph, that acreage was less than 2 million acres, and the virgin stand of some 200 billion board feet had been reduced to one-tenth of the original, practically all in second growth stands.

Uses and properties of the wood are described in detail as well as milling practice, preservation and drying. Its value for naval stores is cited. Ecology covered botanical and commercial range, stand associates, soils, biological, and human influences.

Role of fire in regeneration is described in detail. It is generally proclaimed to be beneficial. The knowledge on the biology of seed development, dissimination of seed, seedbeds, seedling classification, and development was throughly documentd.

Wahlenberg was pessimistic for the success of natural regeneration. He begins this section with the statement that "deliberate regeneration has rarely been accomplished." Following is a litany of problems: irregular seed crops, slow height-growth, and many unexplained failures.

He cites one case of successful direct seeding but generally predicts failure for this technique. Usually the large, nutritious seed is gobbled up by birds and other predators.

He believed that planting is the only viable way to regenerate longleaf pine. He lists a wealth of knowledge, developed in recent years, on the entire process including seed procurement, nursery practice, care of planting stock, seedling grades, and planting practice.

Protection is covered in two sections including fire, hogs, brownspot, and other minor problems. In general, longleaf pine is pictured as resistant to the hazards of the southern environment if given a reasonable degree of protection.

In a major division called "Management," naval stores operations, growth and yield, timber stand improvement, pruning, and harvest cutting is covered. The author states flatly that longleaf should be grown in even-aged stands and recommends either clearcutting and planting or a scattered seed-tree system. In view of earlier sections of the book, however, the seed tree system does not hold out much promise for success.

Despite obvious gaps in knowledge, the monograph set the stage for more research that promised a bright future for longleaf pine.

Indeed, in 1946 a new concept for forest research was developed in the South. Local research centers concentrating on major forestry problems in a defined territory was established. Each was in effect a branch of the Southern and Southeastern Forest Experiment stations. Seven were established in the longleaf pine belt: Alexandria, Louisiana; Gulfport, Mississippi; Brewton, Alabama; Lake City, Florida; Cordele, Georgia; and Charleston, South Carolina.

It was my good fortune to obtain employment as a research forester on the Brewton Branch. In December 1946, I began work to investigate the mysteries of longleaf pine management. T.R. Miller Mill Company had offered the government 3,000 acres of their land for an experimental forest to serve the Branch. My first job was to make a reconnaisance survey of their 200,000 acre forest to select candidate areas for research meeting criteria established by the Station. Arnold Mignery, a young junior forester, and I spent several weeks on the survey and picked out three suitable areas. We all agreed that an area we called "Dixonville" was best.

Director Charles Connaughton sent a committee from New Orleans to make the final selection. This committee was composed of John Curry, Bob Campbell, and Walt Bond. They looked over the three areas and agreed with us that we should try to get Dixonville.

Next day we met with Company officials to present our findings and get a decision from them. Representing the Company were Tom Neal, Sr.; Ed Leigh McMillan; John Miller, Sr.; his son John Richard Miller; and Brooks Lambert. Representing the Station, besides the New Orleans committee, were Ed Gains, officer in charge of the Brewton Branch, Mignery, and I.

After our presentation the officials moved to the far end of the long office and conferred briefly. Then President Neal announced, "The land is yours." Later, in 1947 they signed a lease giving the government use of the land without cost for 99 years. So the "Dixonville Area" became known as the Escambia Experimental Forest.

After surveying the Experimental Forest and dividing it into 40-acre compartments we began work on three compartment-sized studies and one regeneration study of smaller plots.

The management Systems Study, airmed to test Forest management and economic aspects of three rotations for longleaf pine: short (40 years), medium (60 years), and long (80 years) in even-aged and uneven-

In 1947 the Escambia Experimental Forest was established in South Alabama for longleaf pine research.

Jack Neal, son of Miller President Tom Neal, in a 26-year old longleaf pine stand on Co. land planted with HC Furrow Seeder.

aged compartments. Dependent variables were growth and yields, logging and management costs, and value of products. Also, it was expected that knowledge on longleaf regeneration, stand management, and the like would accrue. With four yearly replications, the huge study took 24 of the Experimental Forest's 40 acre compartments.

Each year this study required an enormous amount of time for 100 percent inventories, marking, supervision of loggers, scaling, collecting and posting of data in two large journals--one designated stand and stock; the other cost and value.

Each log and pole had to be scaled in the woods and this compared with the company scale at the mill. Pulpwood had to be scaled after loaded on railroad cars at Brewton and compared with the company tickets. Volume of all products had to be compared with the tree estimate made during the marking process.

Contract loggers hired by Brooks Lambert for the Company did the logging under our close supervision. Detailed costs were collected for truck miles, equipment costs, upkeep of mules, labor rates, as well as stumpage and delivered value of products.

My "Farm Forty" Study was very popular and thousands of visitors viewed results an annual field days during the next 15 years. It was a cast study simulating management of a farm owner of a typical longleaf pine woodlot. All activities including logging and turpentine operations were to be done by the owner with average farm equipment including a wheel tractor, and cut-off saw attached to the PTO of the tractor.

Each fall all harvested products except naval stores, represented by empty barrels, were stacked on a yard for visitors to see. The annual harvest of wood products was limited to 2/3 of the computed growth on the 40 during the year.

The main value of the study was in demonstrating the concept of managing a forest like a crop for annual yields. We emphasized that after logging there was always more and better timber left than before management began.

My third compartment study was known as the Investment Forest. It stimulated practical management by a typical investment owner. Logging was done by company contract crews and management activities were done by station personnel including cruises, marking, timber stand improvement, and prescribed burning. The management plan specified a 60-year rotation and the 640-acre tract was partitioned into compartments, bordered by branches, roads and boundary lines for application of prescriptions. Careful records were kept of all activities and results were analyzed and reported in publications.

A critical protection problem was created by destruction of longleaf pine seedlings by hogs roaming at large whose owners were in violation of State law. Appeals to hog owners did not work, so we decided to arrange for enforcement of the law.

Annual harvests from the Farm Forty study, demonstrating a management system for pine woodlots, were observed each fall by hundreds of visitors.

Sheriff "Doc" Fountain agreed to appoint a "hog deputy" to trap the animals and collect fines from the owners. Albert Harris, the deputy, built a dozen wooden traps with material furnished by the government. He successfully trapped many hogs. Owners, alarmed by the loss of their hogs that always "died" in the pound, hastily built fences and penned their animals. A few, angered by the trapping program, stole traps, and set wildfires. But vigorous action by George Ward, the state ranger, and a cooperative FBI agent caused the vandalism gradually to die down.

In 1947, H.O. Mills, district ranger on the Conecuh National Forest, noticed a heavy crop of longleaf pine cones. He, along with Don Morris, assistant supervisor, decided to try a seedbed burn that summer. To bolster their confidence, they called on the station to have someone come over and help them decide. Dave Bruce, foremost fire investigator, and I met with them and looked at several candidate stands. We all agreed that the burn should be attempted. Mills successfully established seedlings on 26,000 acres that he burned that summer.

In 1951, a drastic change in the Brewton Branch organization occurred. Ed Gaines transferred to Arizona, and Walt Hopkins came to head up a new branch station combining Brewton and Marianna, Florida, with headquarters at Marianna. Florida research would be centered on the Chipola Experimental Forest and be devoted to finding a way to regenerate the sandhills known as "Deserts in the Rain."

Brewton became a subunit of the new East Gulf Coast Branch, and I was responsible for the longleaf pine research there. A drastic retrenchment was essential in the Brewton program, which had been planned for four researchers. Only $15,000 was available to pay the salaries for two technicians, me, and everything else. It was barely enough for salaries with little left for operating expense including rental of office space.

With the blessing of Lew Grosenbaugh and Phil Wheeler, New Orleans division chiefs, we set out to "boil the fat" out of the program. The management systems study was abandoned, so we had the 24 compartments available as a locale for silvicultural studies. Farm 40 and Investment Forest studies were kept. Other studies such as seed tree and forest wall, timing of oak control, Loxley thinning plots, and a few others were put on a maintenance basis.

Obviously, additional funds had to be found if a viable research program was to be continued. Since no Federal funds were available, Walt Hopkins and I contacted T.R. Miller Mill Company people to see if private money could be found. They agreed to head up a program to collect private donations. We were gratified by the response of local people. Contributors were T.R. Miller, Alger

T.F. Miller Mill Company personnel cooperated with Escambia researcher to develop improved methods for planting longleaf pine. Many foresters, who came to see the successful plantations, were encouraged to plant.

Sullivan, Ben May, Mashmeyer, M.C. Stallworth, Charles Dixon, McMillan Trust, and Senator Swift.

With the money, we hired Larry Walker who came in 1953 and helped out for a year writing up a backlog of research and installing new regeneration studies. After Walker left, federal funds became available to hire Bill Boyer, construct an office-lab in Brewton, and hire some extra help. Encouraged by local supporters of our program, Congressmen Bob Sikes and George Grant along with Senators Lister Hill and John Sparkman helped get the federal money to keep longleaf pine research going in the fifties.

In 1952, an Alabama state law was passed outlawing open range grazing of cattle. Miller officials agreed to furnish fencing material and allow grazing on their land to organized cattleman associations who would build the fences for their cattle. We helped organize an association of four cattlemen to graze cattle on the Experimental Forest in accordance with research requirements including limitation of stocking, use of good management practices, and keeping of records for us.

Bud Brantley, Owen Carrol, Yancy Odom and Earl Odom, with our help, built the fence and put 75 cattle on the forest. Cattle were ear-tagged, rounded-up, and weighed twice a year, and data were recorded of costs and returns. Much practical information was learned about problems and benefits of coordinating grazing with timber management. Later, grazing began to interfere with our silviculture studies and eventually all cattle were removed from the forest.

A wildfire in 1947, before the bumper seed crop, established well-stocked stands of seedlings on several management system compartments scheduled to be cut back later to seed trees. When the compartments were cut, I kept a record of the fate of the advance reproduction and seedlings established from the seed trees. I was astonished to find that the advance reproduction survived well, but we were getting practically nothing from the seed trees.

This suggested a revolutionary new way to regenerate longleaf pine--a shelterwood system. I followed up the lead by investigating the history of second-growth forests established on U.S. Steel land in Baldwin County and on Geneva State Forest. Also, I wrote Garrison for information on the second growth established in the twenties in a like manner on Great Southern Lumber Company land in Louisiana. Convinced that shelterwood might offer a way to overcome many of the problems of natural regeneration I wrote an article, published in the *Journal of Forestry* in 1956, suggesting the possibilities of the system. It would require rigid testing before it could be recommended with confidence for longleaf pine. Most foresters were highly skeptical.

F.S. Ranger Jim Hutchins admires seedlings established by a shelterwood system. This shelterwood system, where applied correctly, proved to be reliable throughout the longleaf pine belt on federal, state and private land.

In the next few years Walker, Boyer and I conducted studies to confirm or reject the shelterwood hypothesis and develop knowledge and techniques for applying the system. We learned the best overstory density for preparatory and seed cuts, timing for removal cuts, methods to forecast cone crops, acceptable levels of cone crops and seedling stands, use of fire, logging damage and other basic knowledge. From our studies, we were convinced that the shelterwood system would work by using the techniques we had developed. It was not ready for testing over a wide range of conditions.

Bill Mann and other researchers at Alexandria, Louisiana discovered a bird repellent in 1955 that significantly boosted the opportunity for regenerating longleaf pine. In several years of additional research they perfected guidelines, including more potent repellents, for direct seeding.

One objection to direct seeding was the lack of space control where seed was broadcast. Charlie Lewis built a machine in Louisiana for seeding in rows and John Cassady, officer in charge at Marianna, Florida, also built a successful row seeder. Both machines could only be used on site-prepared ground.

In 1957, I began development of a seeder that would simultaneously prepare the seedbed and plant the seed in rows thus reducing the overall cost. Next year Seaman Hudson secured a grant from Container Corporation to build a prototype machine that was later called the H-C Furrow Seeder.

Louisiana scientists discovered and perfected bird and rodent repellents that made direct seeding of longleaf pine practical.

In 1958 the author invented the HC Furrow Seeder, a machine that simultaneously prepared a seedbed and planted forest seed.

Joe Brady sponsored the construction of a dozen furrow seeders to be sold to interested companies for testing throughout the South. The machines were quickly bought and I assisted many in testing them and developing modified versions. John Hatcher at Aiken, South Carolina, also developed a furrow seeder that was used widely.

Thousands of acres were successfully seeded where the seeders were used properly. Failures were usually due to plowing furrows too deep, using them on unsuitable sites, failure to control brownspot with fire before seeding, using poor seed, and other avoidable errors. But a serious limitation occurred in squirrel-infested areas. The rodents were attracted to the furrows and quickly gobbled up any seed that was planted. No way was every found to deter them.

Phillip Wakely, a long-time planting researcher, published his monograph,--*Planting the Southern Pines*--in 1954. Despite the invaluable guidelines for collection of seed, nursery practice, and out-planting, failures in longleaf plantations were more common than successes. A local example was the failure of a replication of Wakely's regional seed source study in 1954 at Brewton. Our planting on an old field that was burned, under Wakely's personal supervision, succumbed the next year.

In the west Florida sandhills, every planting of longleaf pine failed on sites where sand and slash pine succeeded. Shipman in 1960 reported that overall survival of longleaf in the South Carolina sandhills was only 35 percent. There were so many failures of longleaf plantations throughout the South in the 1950's and 1960's that most foresters considered the practice too risky and switched to slash and loblolly pine.

Despite the accumulation of knowledge for managing longleaf pine, foresters and landowners were discouraged by regeneration failures. Thousands of acres were clearcut, site-prepared with huge machines and planted with slash and loblolly pine seedlings.

By 1960, our Brewton budget was increased enough to support four researchers. While Boyer and I concentrated on shelterwood and compartment studies, Bob Farrar analyzed the Loxley Plot data and began plans for a regional stand and growth study. Phil Craul began basic soil studies involving use of a neutron probe. Research knowledge vital to the success of longleaf pine management was accumulating.

By 1965, despite the interest focused on longleaf by Wahlenberg's monograph in 1946 and siginficant research findings in the postwar years, the species faced a dismal future. Regeneration failures, slow seedling height-growth, infrequent seed crops, and unfounded beliefs had prejudiced many foresters and landowners against the tree.

A modern day army of men and machines moved into the second growth forest with a singleness of purpose. Their objective was to clearcut the longleaf and replace it with other pines. There was no hope of recovery from these operations. Every merchantable tree was cut and removed. Unmerchantable trees and logging debris was pushed into windows and burned or crushed into the ground with huge machines. The area was disked and a new stand of trees planted.

Much of the conversion was done by pulp companies but there were others bent on destruction of the longleaf forest. Even foresters on the southern national forests were following in the footsteps of the pulpmill foresters. Locally, sale of the magnificent Alger Sullivan Longleaf Forest for conversion into slash and loblolly pine plantations was particularly disheartening to us at Brewton.

In the 10-year period between 1955 and 1965 the longleaf pine forest was reduced from 13 million to 7 million acres. Unless a change was made, longleaf pine as an important commercial species would disappear from the South by the mid-1970's.

The Brewton unit was the only place in the South where research was aimed exclusively at longleaf pine. If any significant action was taken to prevent disaster to the forest, we beleived it was up to us. But the prospect was disheartening. There were rumors that Verne Harper would be coming soon from Washington to phase out our research.

STEMMING THE TIDE

On April 24, 1965, Verne Harper came for an inspection visit to Brewton. Earlier in a meeting with Director Zilgitt and his staff in New Orleans, most observers were convinced that he would recommend closing Brewton's longleaf pine research.

Despite our fears for the future, my professional staff and I were determined to make a final effort to save our research program. When the visitors came, I outlined our program and emphasized the importance of the longleaf pine forest and its dismal fate if our research were abandoned. After the conference we toured the Escambia where Boyer, Farrar, and Craul did a masterful job of presenting their research.

After Harper left we got some amazing news from New Orleans. Assistant Chief Harper had decided to make Brewton a full-fledged project with no ties to Marianna and promoting me as leader in charge. Needless to say we were delighted with his decision and plunged into our research with renewed zest.

In order to stem the tide that was rolling against longleaf pine, an aggressive program of research at Brewton was needed. But I was plagued with a shortage of research scientists to do this. Phil Craul left the Service for employment as a professor at a northern college. Both Boyer and Farrar were gone for two years working

on their doctorates: Boyer at Duke University and Farrar at the University of Georgia. Karl Wenger, assistant director, transferred Bob Maple to help me with fire studies.

In the absence of my key researchers, I concentrated on natural regeneration studies. Shelterwood systems were tested in a regional study at 10 locations in North Carolina and South Carolina, Georgia, Florida, Alabama, Mississippi, and Louisiana. Each shelterwood test, usually about 80 acres, was given a code name to simplify recordkeeping and identification.

Our first test, Bicolor-109, was installed on Kaul Trustee Forest in 1966. The seed tree overstory consisted of pines more than 100 years old, probably saved from cutting by the Kaul Lumber Company management plan prepared by the Forest Service in 1905. Our cooperators were Hugh Kaul and Lewis Weaver. Kaul was provided additional land for regeneration and fire studies.

The same year, we established the Ebenezer test on the Centerville Ranger District, Talladega National Forest, in Alabama. Study area was in a 70-year-old longleaf pine stand that apparently originated after the Civil War on an old cottonfield. There were some excellent five-log trees in the stand.

Joe Riebold, supervisor of the Florida National Forests, helped me located the Lavender-Forbes trail on the Appalachicola National Forest south of Tallahassee. Riebold, a graduate of Mont Alto Forestry School in Pennsylvania, had successfully regenerated longleaf pine on the Francis Marion when he was supervisor of the South Carolina National Forests. He was a strong booster of our shelterwood research. Incidently, Joe helped conduct the ranger school meeting I attended at Gulfport, Mississippi, in 1935.

The Spanish Trail test on the Blackwater State Forest was established in well-stocked second growth stands that sprung up when the lumber company cut the virgin timber in the late 1920's. A strong booster of longleaf pine and the shelterwood system was Bonninghauser, assistant state forester, who often visited us and was thoroughly familiar with our Escambia research.

Bob Britt, forester for Eglin Air Force Base in Florida, would have preferred a better site for our Oglesby Ditch test. It was representative of the lower Coastal Plain with severe gallberry and palmetto competition. But, when I pointed out that we needed such a critical test in that province for the study, he agreed.

Our Adams Tract test was made on International Paper Company's Southland Experimental Forest near Bainbridge, Georgia. It was a promising site with an excellent overstory of pines and clean understory. Even with favorable conditions we did not successfully complete the regeneration cycle in 20 years. Our problem was a baffling lack of seed production.

On the Black Creek Ranger District, DeSoto National Forest, in Mississippi, we established the Flat Branch test. Despite damage from hurricane Camille and a small accidental fire, it was the most successful of all our regional tests. The seed trees were fruitful and the understory had been kept clean by the National Forest with frequent prescribed fires. The study area was not far from the Wiggins CCC camp that I visited in 1935. Our seed trees in the test were probably seedlings hidden in the grass at that time.

Our John Hill test on the Kisatchie National Forest in Louisiana was made in an area that had been part of an artillery range in World War II. Our crew used metal detectors to avoid striking unexploded shells while setting control posts. During my Kisatchie visit, George Tannehill, who was stil ranger of the Winn District, invited me up to see people and places I had not seen since the Great Depression.

Our Rome Davis test was established on the Bladen Lakes State Forest near Elizabethtown, North Carolina. Cooperators were Claude Hood, superintendent of the Forest, and Graham Chamblee, assistant state forester. Interestingly, we found earthworks of an old tar kiln in the study area.

In South Carolina, John Tiller, state forester, approved the Society Hill test made on the Sandhills State Forest. Tiller was a district forester when I held a similar position at Aiken in 1942. All 10 shelterwood test areas have been maintained for 20 years and valuable guidelines for applying the system ahve accumulated from them. In addition to the regional shelterwood study, I conducted replicated plot research to add to our fund of regeneration knowledge.

In a 1956 study, seedling height growth had been increased seven-fold by scalping grass exposing mineral soil with a BSW plow. Following this lead, I conducted a seedbed preparation study using an array of treatments on two contrasting sites. Included were combinations of fire, chemical, and mechanical treatments. Dalapon was used to control grass; disking, roto-tilling, and shallow furrows to modify the seedbed mechanically.

To estimate cone crop levels, we used binocular counts of flowers and conelets taken from a single position on one side of the seed tree. Sample trees were felled after binocular counts were made and total number recorded. From these data, blowup factors for binocular counts were derived.

Effect of site, seed crop level, tree age, and other factors on seed per cone were determined. Seed per cone was needed, along with cone crop forecasts and expected tree percent, for various sites to estimate the probable success of seedbed treatments.

When Bill Boyer returned from Duke, he picked up Craul's soil and site studies and conducted some additional regeneration research. He made a study of the effect of heat sums on the development of both male and female longleaf pine. His findings, used for his Ph.D. thesis, were very useful techniques for determining when to make cone-crop forecasts.

Bob Farrar plunged into establishment of his regional growth and yield study when he returned from the University of Georgia. His plots, established on cooperator land, tested a wide array of ages, sites, and stand densities.

Besides his regional growth and yield study, which was installed in natural stands, Farrar also conducted a plantation yield study. Data were taken in all plantations we were able to find throughout the South. Plantations representing many ages, sites, and degrees of stocking were located in eight states from North Carolina to Texas. In both of these regional studies, I worked closely with Farrar securing cooperator support and helping him make some of the examinations.

Farrar also analyzed data that had accumulated for about 35 years from the Loxley plots in Baldwin County,

Escambia researchers conducted a regional study to determine the growth potential of longleaf pine.

Alabama. His publication of results was a valuable accumulation of knowledge on growth and yield of natural stands and optimum thinning densities for various products.

During the 1960's and 1970's growth and yield data from plantations in Louisiana were published by Shoulders, Lowery and others. Their data exploded the generally held myth that longleaf pine grew too slowly to be considered for commercial management.

A seedbed burn established an overdense seedling stand on Kaul Forest that gave Bob Maple an opportunity to try to thin them with fire. Before his study, our careful survey had revealed that a medium stand of about 5,000 seedlings per acre might survive. These were seedlings germinated, which had been expected to die, on bare soil in contrast to others established on duff. At the time they were only one-year-old--.1 inch at the root collar--a size usually expected to be killed.

Maple put in a carefully controlled winter fire under ideal weather conditions and suceeded in saving the 5,000 seedling density. Fire had done a good job of reducing the undesirable stocking of some 50,000 seedlings per acre.

Dave Bruce had thoroughly investigated fire mortality of grass-stage longleaf seedlings during the 1950's. Little had been done to explore the resistance of seedlings height growth to fire damage. Maple installed a basic study using thermocouples and an on-site weather station to determine damage to such seedlings. In addition to the intensity of the burn, correlated with weather, he found that seedling characteristics were important. Those with thin bark, unprotected by green straw, were more severely damaged. Opposites having thick bark, protected by a sheaf of pine straw, were more resistant to damage.

In another study, he observed mortality of grass-stage seedlings in a winter fire under a range of overstory densities. Although mortality increased under heavier densities, overall damage was light in the winter burns.

A prep-cut study area, established earlier to determine optimum overstory densities in a shelterwood system, was used for a fire study. In each density class there were four treatments: winter, spring, and summer fires with a no-burn check. Trees in the overstory were large -sawlog size--about 60-years-old.

In a younger stand, which had been established on management system compartments, Maple installed a similar study testing winter, spring, and summer fires with an unburned check. Overstory trees were about 25-years-old at the time.

I also conducted two fire studies. One tested the concept of using "crop seedlings" instead of "average seedlings" to diagnose the need for a brownspot burn. Normal procedure at the time was to select individual seedlings to estimate degree of brownspot infection and likelihood of seedling damage by the fire. In the crop seedling method, milacres were selected mechanically and the "best" seedling on the milacre was used for the sample. The study revealed that the new method could result in a drastic difference in prescriptions more suited to the needs of the stand.

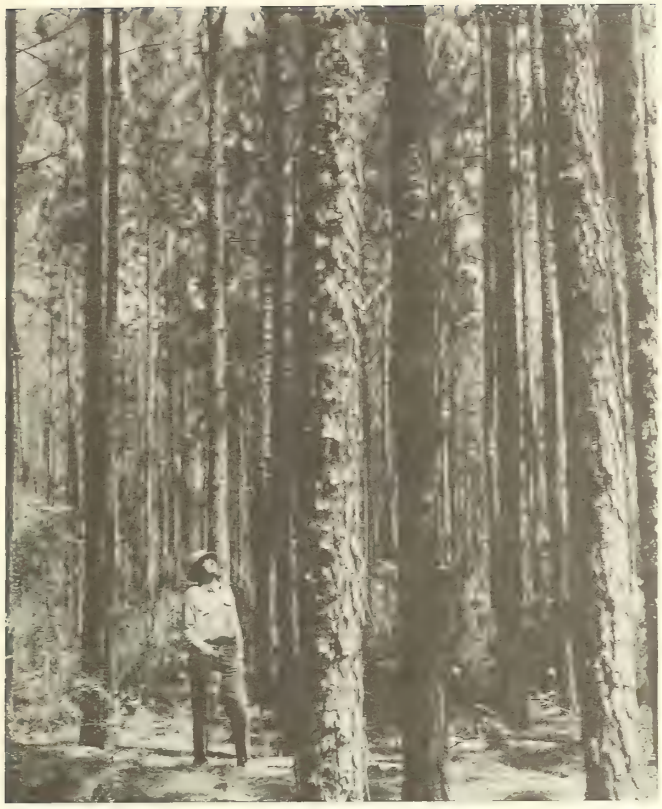
Little was known of the ability of planted seedlings to resist damage in a burn. My other study tested the survival of newly planted seedlings in hot, moderate, and cool burns. Such seedlings proved to be highly resistant to damage, except in hot burns near a forest wall.

Publication of research findings was an important phase of our battle to "save the longleaf." As studies were completed, our results were published in the *Journal of Forestry* and other scientific and popular outlets. *Forest Farmer* ran an article on early results from our shelterwood tests. In 1969 our annotated bibliography listed all significant publications on longleaf pine since Wahlenberg's monograph in 1946.

Our findings on natural regeneration, especially with the shelterwood system, were published in a summary bulletin in 1975. Coverage was comprehensive including basic ecological and biotic factors, an evaluation of several regeneration systems, and detailed coverage of the shelterwood system.

Farrar summed up findings from his regional growth-and-yield study in a bulletin. It gave reliable and encouraging data on the potential of thinned natural stands. His publication was much more useful than the standard Miscellaneous Publication 50, which was based on unmanaged stands, giving growth and yield to low for managed stands.

1968 was a year of significant progress. Our article describing amazing results with shelterwood regeneration on a steep mountain slope was published. The Joseph Springs area on the Heflin Ranger District, Talladega National Forest had been selected for a test of seedbed burning. The pine overstory had been cut back to about 30 square feet of basal area per acre, which is our current recommendation of density for the seed cut in a shelterwood system. The entire area of about 50 acres was burned during the summer before the good 1961 seed crop except for small plots protected from fire. Because of the steep slope, we had to get special permission from the Region to make the burn. Excellent reproduction was established everywhere the



Suitable thinning densities for longleaf pine stands were developed.

burn prepared the seed bed. On unburned plots, few seedlings were established. Many people have marveled at this beautiful young stand of longleaf pine at the northern limit of the species.

With Director Tom Nelson's encouragement, we conducted a Longleaf Pine Symposium at Brewton in October. Nelson acted as master of ceremonies for presentations on brownspot, genetics, planting and direct seeding, growth and yield, site, and status of longleaf pine management and regeneration.

About 175 people from states throughout the longleaf pine belt attended the meeting, which included a tour of the Escambia on the second day.

In December 1969, Carl Mueller and I put in a test on T.R. Miller Mill Company land near Brewton. Where we used superior seedlings, better than Wakeley's grade one, carefully protected in transit from the nearby Haus Nursery, and accurately planted at the proper depth, survival and growth were excellent. A very important factor was site preparation. After clearcutting, any standing trees remaining were sheared, debris raked into wind rows and burned, and the whole area disked with a large machine. Our planting site was free of competition, and most important, any source of brownspot infection from diseased seedlings had been eliminated.

Soon the word spread of Miller's remarkable success planting longleaf pine, and foresters began to learn the key to a practice that had been largely abandoned in the south. Because of the new development, many requests came for instruction in planting longleaf pine. Some people eagerly seeking information were foresters on Conecuh National Forest; Geneva State Forest; John White on DeSoto National Forest in Mississippi; foresters with the North Carolina Forest Service; and others.

Encouraged by the success with longleaf planting, Ed Leigh McMillan II agreed to have his crews make some local tests of natural regeneration using a two-cut shelterwood system. Seven such tests were made on the Escambia: Red Branch, Cobb Creek, Highway-North, Highway-South, Compartment 101, Lindsey North, and Investment Three. The tests were very successful, and soon T.R. Miller foresters began using shelterwood on an operational basis on Company land.

T.R. Miller Mill Company of Brewton, Alabama, and other loyal supporters, helped save the longleaf. Brooks Lambert, woodland manager for the company, before his death soon after the photo was taken, views a superior 30-year-old longleaf.

In the 1970's, sentiment against longleaf pine began to fade away and gradually foresters became interested in favoring the species in their management. To encourage the trend, we participated in workshops, made individual contacts and conducted tours of the Experimental Forest. These activities were all aimed to transfer research findings into practice.

Lamar Beasley, supervisor of Kisatchie National Forest and a strong devotee of longleaf, invited me to conduct a workshop for his personnel. Response of the foresters was gratifying and spoke well for the future for longleaf. One nagging problem was destruction of seedlings by open range hogs.

Leon Cambre, supervisor of Mississippi National Forests and another strong supporter of our longleaf pine research, gathered up his men and came to Brewton for a workshop. After an indoor session, most of the two days was spent on the Escambia. This group was also extremely supportive of the species.

The group of foresters from all national forests in the longleaf belt was also taken to selected sites on the Escambia, Miller plantations, and Conecuh National

Forest, to view and discuss management problems on the ground.

Additionally, Mooney Nalty sponsored a longleaf pine workshop, organized by the Alabama Forestry Commission, that was held at Brewton. It was attended by company foresters from southwest Alabama, AFC foresters, and other including Zebulon White, the Louisiana consultant. Convinced in the potential of longleaf, many pulp mill foresters began to include it in their planting programs.

Bill Balmer, softwood specialist with State and Private Forestry stationed in Atlanta, organized a longleaf pine workshop that was held at Mobile. Boyer and I presented talks on longleaf pine to the large enthusiastic group of foresters. They also toured the Escambia.

Although Brewton was the only project where research was devoted exclusively to longleaf pine, there were other people doing significant research on the species. We closely followed their publications and made visits to see their research and discuss findings with them.

Our travels included Alexandria Forestry Center in Louisiana; Lake City in Florida; Cordele in Georgia; Savannah River Project and Charleston Center in South Caroline; and Genetic Institute in Mississippi. Also, we spent a day with Herb Stoddard, the quail authority, and Ed Komerek at Tall Timbers near Thomasville, Georgia.

Moreover, International Paper Company was doing some research on longleaf pine and provided land for our Adams Tract shelterwood test. We visited their Southland Experimental Forest near Bainbridge, Georgia.

To guide our research, we were given the advice of a technical committee. Members were T.E. Maki of North Carolina State; Claude Brown of the University of Georgia; Bonninghausen of the Florida Forest Service; Bigler Crow of Louisiana State University; Walter Beers of Buckeye Cellulose; Bob Allen of Clemson University; and Jim Sabin, assistant regional forester in Atlanta.

When I retired from the Forest Service in December 1974, Jim Sabin hired me for consultation on regional longleaf pine problems. The work took most of 1975. I visited 24 ranger districts on 13 national forests in seven states. This included every national forest in the longleaf pine belt where an estimated 725,000 acres of the species was growing.

Purpose was to give on-the-ground advice and training on problems and to encourage more consideration of longleaf in management problems. In my travels, I contacted 175 people in field sessions and dozens more at supervisors offices. Practically everyone, with a few notable dissenters, displayed a sincere interest in longleaf pine and were eager to learn. A broad spectrum of national forest people welcomed me: supervisors, staff men, foresters, wildlife and other specialists, technicians, and forest workers.

As a rule, two days were spent at each ranger district beginning with a get-acquainted conference to list longleaf pine problems and select field points to visit. Most of the time was spent on the forest formulating prescriptions, demonstrating techniques, working out solutions to silvicultural and management problems.

Mooney Nalty, a booster of longleaf pine, hunted quail on his forest near Brewton, Alabama. Longleaf forest, prized for their beauty, are efficient producers of high-quality wood products on sandy land and furnish an ideal habitat for quail and other wildlife.

A written report was submitted for each ranger district and the Savannah River project. In addition to a general description of the district, including the acreage and character of longleaf pine stands, it listed by recommendations for natural regeneration, direct seeding, planting, precommercial and commercial thinning, fire use, protection, and solutions to special problems.

Use of a two-cut shelterwood system was generally recommended for natural regeneration. Detailed instructions on each step in applying the system were given as well as criteria for deciding between natural and artificial methods.

Except for good results in Florida, particularly with row seeding on the Appalachicola National Forest, not much successful direct seeding of longleaf pine was found. Because of this and my appraisal of the poor chance for success in the areas visited, I seldom recommended direct seeding. In some places supplemental seeding of small areas in shelterwood stands on years of good seed crops was suggested. We did find an excellent catch of seeding on the Oakmulgee District in Alabama on an area devastated by a tornado.

My planting recommendations generally followed my experience with T.R. Miller Company and other successful longleaf planting in Alabama, Mississippi, and North Carolina. Emphasis was put on complete site-preparation, high-grade seedlings from selected nurseries, extreme care in transit including cold storage, and accurate planting at the proper depth. Crew training and supervision were stressed. Containerized planting was discussed, but I usually recommended postponing its use until later. Fire-use covered burning strategy, estimates of probable damage, and other details of prescriptions. Solutions were also recommended for protection problems such as brownspot infestations, and hog and cattle damage.

We found little need for precommercial thinning. A few stands of saplings, however, had more than 2,000 dominant stems per acre. In such stands we recommended thinning back to about 1,000 stems per acre using practical measures. A recently invented remote control skidder, the "Radio Horse," may provide a means for thinning overstocked natural stands.

We prescribed thinning of commercial-sized stands from below leaving the best dominants and codominants. A density of 60 square feet basal area per acre for younger stands was recommended; 70 square feet for older stands. Off-site planting of slash pine and invasion of good longleaf pine sites by slash and loblolly pines was frequently observed. I recommended that many of these areas be converted to longleaf pine at the time of harvest cuts.

On five districts in Alabama; Shoal Creek, Talladega, Oakmulgee, Tuskegee, and Conecuh, we estimated 132,000 acres in longleaf pine type.

Shoal Creek was near the northern limit of the longleaf pine zone. Much of it was on steep mountain slopes and soils were generally too heavy for longleaf because of the danger of frost-heaving of fall-germinated seedlings. We estimated, however, that 9,000 acres were suitable for the species. A special problem here was use of fire, and we discussed strategy to minimize risk of damage.

Talladega also had mountain slopes, but there was more land suitable for longleaf pine--an estimated 25,000 trees. Considerable good longleaf land is in LIM category prohibiting commercial management.

Oakmulgee was the locale for our Ebenezer shelterwood test. Stand conditions were similar to Talladega with some mountains to deal with but considerable land -- an estimated 45,000 acres--suitable for growing longleaf pine. A tornado had destroyed timber on 100 acres or so. Prompt direct seeding of the cutover area with longleaf had established good seedling stands. Interestingly, this area was visited in the early 1800's by Charles Lyell, the British geologist, who speculated that the excellent longleaf pine resulted from control of competition by Indian fires.

Tuskegee was at a lower elevation than the three mountain districts, but usually longleaf occurred in narrow bands along the top of ridges. This topography complicated the use of fire and other silvicultural practices. Also, there were open areas where seeding and planting had failed on very droughty soils. We estimated only 3,000 acres suitable for longleaf pine management.

Conecuh was by far the best district for growing longleaf pine. It covered favorable coastal pine soils and a gentle terrain. We estimated 50,000 acres of potential longleaf land. Despite the fact the large portions had excellent stands of second-growth stands suitable for use of shelterwood, an unwanted amount of regeneration had been done by clearcutting and planting of slash pine. I strongly recommended against such planting. Future regeneration should concentrate on natural regeneration using a shelterwood system where adequate seed trees are available.

On five districts in Florida, Appalachicola, Wakulla, Seminole, Lake George and Osceola, we estimated 86,000 acres in longleaf pine.

Appalachicola had much of the area occupied by flatwoods, which were considered by the silviculturist to be unsuitable for longleaf pine. The forester, somewhat prejudiced against longleaf, estimated only 10,000 acres suitable for the species. They had been unusually successful in row-seeding longleaf pine and much of their regeneration will be done by that method. At the time, they were considering allowing cattle to graze on the national forest under a lease system. I suggested several measures to include in the leases that would help coordinate grazing with timber management.

Wakulla District had some flatwood areas but they were not as extensive as on the Appalachicola. We estimated 35,000 acres suitable for longleaf pine. This district was the locale for the highly successful Lavender-Forbes shelterwoods test. Unfortunately, there was much off site planting of slash pine. I recommended early harvest of the unthrifty pines and replanting with longleaf. A small administrative test of containerized planting was suggested.

Seminole, the most southerly district, had large areas where direct seeding and planting had failed. Due to severe predator pressure and droughty soils, I recommended planting instead of seedling. Improved planting methods were recommended.

Lake George District had beautiful longleaf on sites known locally as "longleaf pine islands"--sustained between thick stands of sand pine. Here also was a large backlog of failed plantations. Because of the sensitive nature of public relations, I recommended some modification of site preparation measures for planting.

Osceola District had a unique regeneration problem. There were well-stocked stands of longleaf with severe understory palmetto competition. At the time, control of

palmetto required heavy disking that caused damage to seed trees. Apparently, such stands would have to be clearcut and planted where regeneration was required. I referred the problem to the competition-control project at Auburn, and they have found a way chemically to control palmetto. We estimated 21,000 acres suitable for longleaf pine based on a detailed soil map that showed height of watertables. A serious problem on the Osceola, however, was severe damage by cattle grazing.

All districts in Mississippi were on the DeSoto National Forest. The three--Biloxi, Black Creek and Chickasawhay--enjoyed favorable coastal plains soils and a gentle terrain. We estimated 50,000 acres of longleaf for Biloxi, 125,000 for Black Creek, and 70,000 for Chickasawhay. Much of the longleaf had regenerated naturally when the virgin timber was clearcut.

Where seed source was adequate, all districts, especially Black Creek, had made admirable progress installing shelterwood systems. Survival in plantations was good, but there was a serious brownspot problem with the nursery stock obtained from Ashe Nursery. The problem was referred to Albert Kais, a pathologist stationed at Gulfport, for help. He found and corrected it.

On five districts in Louisiana; Winn, Catahoula, Evangeline, Kisatchie, and Vernon, we estimated about 115,000 acres were in longeleaf pine.

Winn, the northern district, had less land in longleaf pine than the others. Many of the virgin stands of longleaf had been replaced with loblolly and shortleaf pines. Near the Gum Springs tower, we inspected an excellent stand of longleaf that originated from the 1935 bumper crop 40 years earlier. When I was on the district in 1935, we had scalped part of the area for seedbed preparation. On this district I suggested an administrative test of Dalapan or Simazine to prepare the site for planting.

Evangeline and Catahoula were much alike, with good longleaf sites: 20,000 acres on Evangeline: 21,000 acres on Catahoula. Harvey Benson on Evangeline was successfully hand-planting containerized seedlings with a dibble he invented.

The "burning" Vernon District had many well-stocked longleaf stands with a clean understory--the result of many fires and heavy cattle grazing. We estimated 44,000 acres of longleaf with 16,000 subject to military restrictions.

Kisatchie had a more rugged terrain then the other Louisiana districts. Some of the land had been classified LIM and was not available for commercial management. Altogether, there were 20,000 acres of longleaf pine on the district.

In Louisiana, every district except Winn had severe cattle and hog damage to contend with. As elsewhere, much original longleaf type was now occupied by loblolly and shortleaf pines. Some conversion back to longleaf pine at the time of harvest cuts was recommended.

In Texas the two districts--Yellow Pine and Angelina--were similar but there was more longleaf pine type on Angelina--30,000 acres versus 7,000. Some of the 40 year old stands had been regenerated with seedbed burning by Supervisor Bishop before the 1935 crop. A unique problem on the Angelina was severe pocket gopher damage in some plantations.

Both districts I visited in South Carolina were on the Francis Marion National Forest; however, soils were quite different on the two districts. Much of the Witherbee District had a high watertable that caused flooding when the stand was clearcut for planting or seeding. All seedlings in a Hatcher Furrow seeded area died when water entered the deep furrows. Because such flooding was lethal to longleaf seedlings, shelterwood was the preferred system where there was sufficient seed source. Fortunately, most of the stands scheduled for regeneration had a well-stocked overstory.

Soils on the Wambah District were better drained and easier to regenerate. This district had done some successful precommercial thinning. We estimated 24,000 acres of longleaf pine on this district--20,000 on the Witherbee.

In South Carolina I also visited the Savanna River Project. Here many slash pine plantations had suffered severe ice damage. Foresters were clearcutting them and planting longleaf pine. Seeded stands of longleaf pine seedlings had poor stocking but fill-in loblolly pine reproduction raised stocking to adequate levels. We estimated 47,000 acres of longleaf pine on the Project.

In North Carolina, the two districts were quite different. Uwharrie in the Piedmont had only 1,000 acres suitable for longleaf pine. Most of the soils were too heavy and were at the northern limit of the longleaf pine zone. There was too much risk of frost-heaving of fall-germinated seedlings.

The Croatan District, near the Atlantic coast, had 20,000 acres suitable for longleaf pine. Ranger Mills, son of the conecuh ranger in Alabam who made the successful 1947 seedbed burn, pointed out a unique advantage of the longleaf pine type. There were large portions of the district in pocosins, a forest type extremely vulnerable to dangerous crown and ground fires. Fortunately, they were surrounded by longleaf forests that could be prescribed burned creating a wide band of fire proofing.

After the regional contract was completed in 1975, several supervisor's offices engaged me for follow up assistance. I worked 4 additional years in Alabama, 2 in Florida, and 4 in Mississippi.

Besides consultation on national forests, I assisted many others on longleaf pine problems. Some of my clients were Koppers Company, Alabama River Woodlands, T.R. Miller Mill Company, Loper Lumber Company, Piedmont Forester, Victor Beadle Forest, International Paper Company, Huxford Trust, Auburn University, and Bennett and Peters, forestry consultants.

Eley Frazer III, president of F & W Forestry Services at Albany, Georgia, had me provide training for his foresters and prepare silvicultural reports for seven of his clients. After a field examination of the properties, I wrote reports for Wiregrass, Alred, Wildfair, T.L. Tyler, Seminole, H.B. Wetherbee, and Gravel Hill forests.

On December 1978 Georgia State Forester John Mixon, who was then chief of forest research for the Georgia Forestry Commission, asked me to conduct a study. Its objective was to find a way to plant longleaf pine successfully in Georgia. I signed a contract in January 1979 to investigate the problem.

To get preliminary ideas for the study we planted seedlings from the Reidsville Nursery in February on the Dixon Memorial State Forest near Waycross. A survival count in June revealed that shallow planting and exposure of seedling roots to drying at the planting site was the major cause of loss. Surprisingly, seedlings kept

in cold storage a month before planting survived better than those freshly dug.

Our major study tested Alabama versus Georgia seedlings; good versus poor grade, cold storage versus freshly dug stock, at five locations: Soperton, Albany, Butler, Waycross (Dixon Memorial Forest), and Valdosta.

Seedlings were planted in February 1980 mostly with Whitfield clipwheel planters, Unfortunately, the Georgia seedlings were greatly over-sized and were severely pruned so they could be planted. Accuracy of planting for Alabama seedlings varied from 83 percent at Butler to 61 percent at Albany reflecting the difference between experienced longleaf pine planters and untrained men. Except for Soperton where 80 percent of the seedlings were planted correctly most planting of Georgia stock was poor--less than 60 percent.

Survival was determine for all correctly planted seedlings in May. Alabama seedlings averaged 82 percent compared with 63 percent for Georgia seedlings. Alabama seedlings that were kept in cold storage survived somewhat better than those freshly dug: 86 percent versus 84 percent.

Good grade Alabama stock did much better than the poor grade: 86 percent versus 58 percent. Overall average for all Georgia seedlings was 64 percent.

After the May exam, all plantations suffered a severe drought. Rainfall deficiency from June to September averaged 7 inches at Soperton, 13 inches at Albany, 7 inches at Butler, 9 inches at Waycross, and 9 inches at Valdosta.

Our March 1981 exam revealed the ravages of the dry season. For good grade Alabama seedlings that were planted correctly survival had dropped to 52 percent; varying from a low of 30 percent at Albany to a high of 75 percent at Waycross. Again seedlings from cold storage survived better than those freshly dug: 54 percent versus 49 percent.

Low survival was due to two major factors: rainfall deficiency and poor site preparation. Albany had a 13 inch deficiency of rain and seedlings were planted on a thickly sodded pasture that had the rows subsoiled. Although Waycross experienced a 9-inch rainfall deficiency, survival was surprisingly good--75 percent. Good site preparation and excellent soil conditions paid off.

After the 1981 examinations, I prepared a plan for a new study to find out if containerized seedlings would survive better than 1-0 nursery seedlings. James Barnett at Alexandria agreed to furnish the containerized stock and John Mixon approved the plan. But due to personnel circumstances I was unable to proceed with the study.

Mixon asked Bill Boyer to follow through on Georgia planting research. Boyer agreed and came to Brewton to discuss a follow-up study. His plan featured a comparison of containerized seedlings versus 1-0 nursery stock. Early results indicate that both growth and survival for the containerized seedlings will be superior to that for nursery stock. Thus a method is suggested for planting under circumstances where good 1-0 stock is not available or where the planting chance is unusually difficult.

In February 1979, my article entitled *The Longleaf Pine Story* was published in the *Journal of Forest History.* It covered the historical as well as the managment aspects of the forest. Reprints of the article were widely circulated among southern foresters. A revised version was published in the Christmas issue of the *Southern Lumberman.*

By the early 1980's, our "battle to save the longleaf" had achieved some significant victories. The impending doom of the forest in the 1970's had been averted and the tide that was rolling dangerously in the 1950's and 1960's had slowed down to a trickle.

A PLACE IN THE SUN

In 1986, as the last chapter in this "saga of longleaf pine" is being written, a new day has dawned. Prejudices against longleaf are fading away and there is a revival of interest in the species. Ed. Kerr, a prolific writer on forestry subjects from Louisiana; William Voight, a native of longleaf pine forests of Georgia; Eley Frazer III, president of F & W Forestry Services; and others have written articles describing the trend.

Why has this change occurred? Our exhortations during the 1960's and 1970's undoubtedly played a role, but there is a more important reason. Success has been conclusively demonstrated for regeneration practices, and there has been a significant increase in knowledge of the growth potential of the species and the important role of genetics. A better understanding of longleaf has built the confidence of many people.

A reliable natural regeneration system has been rigorously tested. Where properly applied on suitable sites, a shelterwood system has proven reliable. Failures are generally due to providing too few seed trees, inadequate competition control, failure to coordinate burns with seed crops, or other unwise practices.

Natural regeneration provides an attractive low-cost system where site and stand conditions are suitable, and it meets the financial and other requirements of the landowner.

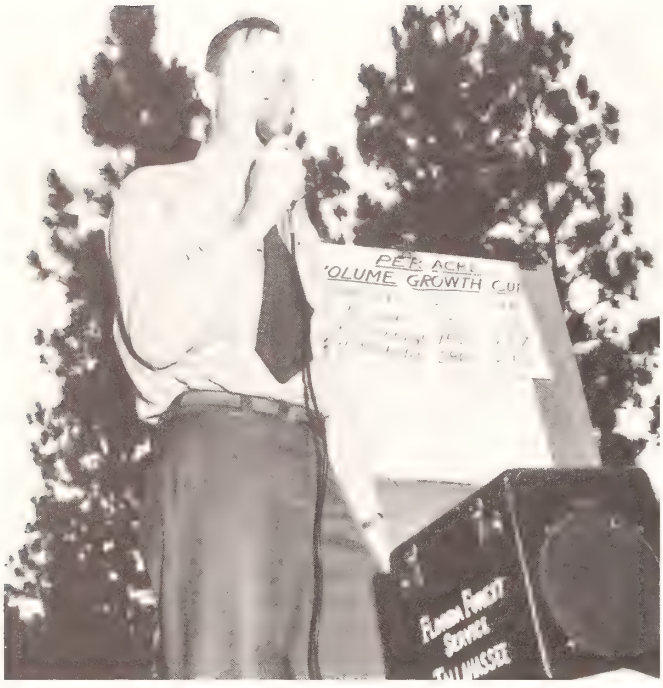
During the last 20 years the dismal failure of longleaf pine plantations has been reversed. Now successes have become the rule. Significant improvements in the forestry have been largely responsible. Nurseries are producing better stock--some introducing mycorrhizae into seedbeds. Grade one or better seedlings are used. Seedlings are handled with great care from the nursery bed to the planting site--often with cold storage protection all the way. Particular emphasis is given to site preparation, including a drastic reduction of competition and elimination of all sources of brownspot infection. Seedlings are correctly planted, usually with machines, at the proper depth.

Even pulpmill foresters, formerly reluctant to plant longleaf pine, are confidently using it in the mix of species in their planting programs.

Containerized seedlings are showing superior growth and survival under adverse conditions. Use of them promises to be the wave of the future for special situations.

Direct seeding, after dramatic success on large cutover tracts, particularly in Louisiana, is now used on a more limited scale because of seed cost, squirrel predation, and unfavorable sites. But it still is a viable practice to seed spoilbanks, or for quick reforestation of disaster areas.

Since the 1930's, fire use in longleaf pine forests has gradually developed into standard practice for seedbed preparation, brownspot control, competition control, wildlife habitat improvement, and hazard reduction. If



In the 1960's and 1970's a vigorous campaign of workshops, seminars, consulting and large-scale tests, was conducted to translate research findings into practice. Prejudices against longleaf pine gradually began to fade away.

carefully prescribed, all of these are legitimate uses, but there is some evidence today that the practice has been overdone. Growth in sapling stands has been reduced with burns that served no useful purpose, and research today is beginning to indicate that fire may cause some reduction in growth of older stands. Not only should fires be carefully prescribed and executed, but it is well for the forest manager to keep abreast of the latest research findings.

Reliable growth and yield information, for both natural and planted stands, is available. Recent findings have definitely shown that longleaf pine produces satisfactorily with proper management on suitable sites. These data have also indicated the sites where longleaf pine does best. It grows well on a wide variety of sites with adequate competition control, but in comparison with other species does best on the deep sandy uplands.

Longleaf is well adapted to the hazards of the southern environment. It is greatly superior to other pines in its resistance to damage by fire, insects, and all diseases except brownspot. An excellent producer of high-quality material, especially poles and piling, it grows well on sterile sandy sites.

Geneticists have discovered that strains of longleaf are resistant to the brownspot disease and make faster height growth than their fellows. Selections of such strains, grown in seed orchards, provide seed for the nurseryman to grow superior seedings.

Variation in genetic qualities is also an important consideration in natural stand management. Some trees inherently produce more cones than others and should be selected for seed trees in shelterwood cuttings. Thinning operations should favor the best dominants and codominants for leave trees.

Research has also shown that a component of natural seedling stands are resistant to brownspot and make significantly better height growth--8 more feet during a 24-year period in one study. Carefully prescribed burns for brownspot control favor these "crop" seedlings.

Another development in 1986 has greatly brightened the future for longleaf pine. Roger Dennington, softwood specialist for Cooperative Forestry in the USDA Forest Service's Southern Region, has organized an ambitious technology transfer program for the species.

Roger was a ranger in Mississippi when I visited his district in 1975 during my regional consultation project. Like many Mississippi people, he was eager to learn and was sincerely interested in promoting longleaf pine. In 1982 when he assumed his present position, he came to Brewton to discuss the status of longleaf pine and agreed to encourage management of the species.

Roger has come through with flying colors. His program is aimed not only to stop the decline in longleaf acreage but to actually increase it. He has recruited a large group of knowledgeable people to help, has money to do the job, and has secured the approval of his superiors and the director of the Southern Station. Prospects are extremely bright for success.

In view of Dennington's goal one many ask: How much acreage should be devoted to longleaf pine? Obviously, much of the original 60 million acres should remain in present uses such as agriculture. Also, other pines that replaced longleaf should continue to occupy a portion because of site quality and landowner objectives. But in my travels I have observed many sites where longleaf pine would definitely be the best choice. In many cases I have recommended a conversion to longleaf pine when the final harvest cut is made. It would be hard to estimate the actual acreage that could best be devoted to growing longleaf. I am convinced, however, that doubling or even tripling the present 4 million acres now occupied by the species would not be out of line.

Five years' results from management of a longleaf pine forest for one of my clients suggests a desirable pattern for nonindustrial private landowners and companies as well. Eighty percent of the typical second growth forest was in longleaf pine with the remainder in slash pine-hardwood bottoms. Understocked, the forest had a dense midstory of unmerchantable hardwoods and rush. Site for longleaf pine was average: index about 70 feet height growth for the tallest trees at 50 years. Soils in the uplands are well drained and suited to growing longleaf. The bottoms provide cover for game and make good firebreaks.

A financial analysis of the growth potential of site 70 longleaf pine indicate a dollar return of 15 percent annually on the investment in well-stocked stands for the 10-year period from age 50 to 60. In the next 10 years, the return would drop to 7 percent. So a 60-year rotation was selected for management.

The forest was divided into 50 to 100 acre compartments bounded by roads, branch bottoms, and property lines. Within each compartment even aged longleaf pine stands will be grown on the uplands; uneven aged slash-hardwood stands in the bottoms.

Cutting during the first 10-year cycle is controlled by two methods. Volume removed in logs and poles (mostly trees 9.1 inch diameter at breast height [dbh] and up) is limited to less than the estimated growth in board feet on the entire forest during the period. Acreage regenerated to longleaf pine is limited to one-sixth of its total acreage on the forest. Aim is to eventually develop ages ranging from 10 to 60 years. Unfortunately, most

stands are around 60-years-old and conversion to younger age classes is needed. Too rapid a conversion, however, would be undesirable. It would interrupt a sustained cash flow and be undesirable from the esthetic and game standpoint, besides creating an unbalanced age-class distribution.

Because of understocked nature of the forest, all cutting during the first 10 years is for the purpose of regenerating sparse stands. Those with better stocking will be left to grow.

To avoid the expenditure of large amounts of capital for regeneration, a shelterwood system is prescribed where stand and ground conditions are suitable. Besides reducing costs, growth on the seed trees would provide an additional volume of high-quality material to be harvested in the early years of management.

Before cutting, a survey is made in each compartment to determine if there are enough seed trees for a shelterwood system. If so, a seed cut is prescribed to begin the regeneration process. If the seed source is deficient, the compartment is scheduled for clearcutting and planting.

The thick midstory of unmerchantable material was a serious barrier to regeneration. Fortunately, a contractor was found to chip the unmerchantable material for fuel wood to be used by a nearby pulp mill. The job is done before logging with little damage to merchantable trees at no cost to the landowner. Chipping not only eliminated the need for windrows in planting operations, but site-prep costs were also reduced. In natural stands, chipping made prescribed burning much more effective and facilitated marking and logging. Game habitats were improved by the operation.

Well-timed seedbed burns before the 1983 cone crop in shelterwood stands established fully stocked stands of longleaf pine seedlings on 376 acres. Also, 430 acres have been planted successfully during the 5 years where the site was prepared properly. When seed trees are removed in the shelterwood stands, we will have 806 acres of well-stocked seedling stands free to grow.

During the 5 years, gross returns to the landowner have averaged about $25 per acre per year. Revenue was derived from stumpage sales of pine poles, logs, pulpwood, posts, hardwood logs and pulpwood. Cutting less than growth, we now have more and better timber than before management began, and the forest has contributed materially to the landowner and the general economy.

This tract clearly shows the economic benefits of managing second-growth longleaf pine forests. High-grade wood products can be produced, substantial dollar returns obtained, employment for forest workers furnished, and the woods will abound with quail, deer, turkey, and other game thriving in an ideal habitat.

But there are other important intangibles that gladden the hearts of those who love the culture of the land. Who can describe the beauty of a blanket of grass penetrated by snow white pine buds searching for the sun; of the thrill of a quail hunt through a parklike forest cooled by a resinous breeze? Rusting turpentine cups and arrowheads buried in the sand, ancient churches built of heartpine, magnificent southern mansions, and old logging photos are reminders of centuries of human drama enacted on the forest stage. The historical attraction of longleaf pine is important to many people.

Then there is the challenge of salvaging our forest heritage, battered and bruised by man, but dependent on him for salvation.

The most serious threat to a future for longleaf pine has not been a lack of technology but the attitude of people. There were those who championed a cause that seemed destined to be lost; however most seemed bent on destroying the forest.

Now public opinion seems to be changing, and there is real hope for the future. The magnificent virgin forests are just a fond memory. But as long as trees grow and winds blow, the gentle breezes will ripple the longstraw crowns creating the sweetest music this side of the Mason-Dixon line.

SELECTED BIBLIOGRAPHY

Bass, Robert D. 1976. Swamp Fox. The Sandlapper Store Inc. Lexington, SC.

Barnett, James F., and McGivrey, John M. 1981. Container planting systems for the South. USDA FS SO-107. So. For. Exp. Sta. New Orleans, LA.

Chapman, H.H. 1926. Factors determining natural regeneration of longleaf pine in LaSalle Parish, Louisiana. Yale School of Forestry Bulletin 16.

Clarke, Thomas D. 1986. The southern pine fleet of World War I. Jour. of For. Hist. January 1986.

Crow, A. Bigler. 1982. Fire ecology and fire use in the pine forests of the South. School of Forestry and Wildlife Mgt. Louisiana State University, Baton Rouge, LA.

Croker, Thomas C., Jr. 1956. Can the shelterwood method successfully regenerate longleaf pine? Jour. of For. 54:258-256.

Croker, Thomas C., Jr. 1968. Longleaf pine: an annotated bibiiography 1946-1967. USDA FS SO-35. So. For. Exp. Sta. New Orleans, LA.

Croker, Thomas C., Jr. 1979. The longleaf pine story. Jour. of For. Hist. Vol. 23, No. 1

Croker, Thomas C., Jr., and Boyer, W.D. 1975. Regenerating longleaf pine naturally. USDA FS-SO-105. So. For. Exp. Sta. New Orleans, LA.

Farrar, R.M., Jr. 1979. Growth and yield predictions for thinned stands of even aged natural longleaf pine. USDA FS SO-156. So. For. Exp. Sta. New Orleans, LA.

Harper, Francis. 1958. The travels of William Bartram. Yale University Press. New Haven, CT.

Hickman, Nollie. 1962. Mississippi harvest: lumbering in the longleaf pine belt, 1840-1915. Univ. of Miss. Press. Oxford, MS.

Lawson, John. 1719. Lawson's history of North Carolina. Garrett and Massie. Richmond, VA.

Lohrey, Richard and Bailey, Robert L. 1977. Yield tables and stand structure for unthinned longleaf pine plantations in Louisiana and Texas. USDA FS SO-104. So. For. Exp. Sta. New Orleans, LA.

Mann, W.F., Jr. 1970. Direct seeding longleaf pine. USDA FS SO-57. So. For. Exp. Sta. New Orleans, LA.

Maple, William R. 1970. Prescribed winter fire thins dense longleaf pine stand. USDA FS SO-104. So. For. Exp. Sta. New Orleans, LA.

Morris, D.J.; Mills, H.O. 1948. The Conecuh longleaf pine seedbed burn. Jour. of For. 46:646-652.

Oates, John A. 1950. The story of Fayetteville. Dowd Press, Inc. Charlotte, NC.

Schiff, Ashley L. 1962. Fire and water--scientific heresy in the Forest Service. Harvard Univ. Press. Cambridge, MA.

Siggers, P.V. 1944. Brownspot needle blight of pine seedlings, USDA Tech. Bull. 870. So. For. Exp. Sta. New Orleans, LA.

Snyder, Bayne; Dinus, Richard J.; Derr, Harold J. 1977. Genetics of longleaf pine. USDA FS WO-33. So. For. Exp. Sta. New Orleans, LA.

Stoddard, H.L. 1931. The bob white quail. Charles Scribner. New York.

Wahlenberg, W.G. 1946. longleaf pine. Charles Lathrop Pack Forestry Foundation. Washington, D.C.

Wakeley, P.C. 1954. Planting the southern pines. USDA Agri. Monograph 18. So. For. Exp. Sta. New Orleans, LA.

BIOGRAPHY
THOMAS CALDWELL CROKER, JR.

BORN: August 19, 1911 in Forest City, North Carolina

EDUCATION: Bachelor's of Science in Foresty — North Carolina State (1933)
Graduate Studies: Journalism University of Oklahoma
Biometrics USDA Graduate School

CAREER: Forty Years - USDA Forest Service:
National Forests - Pisgah, Cherokee, Kisatchie, Flathead Shelter belt, Timber Production War Project, Guayule.
Southern Forest Exp. St. - Project Leader
South Carolina Forest Service
North Carolina Forest Service
Forestry Consultant - 12 years

OTHER: Author of more than 50 technical publications including articles for *American Forests* magazine and *Journal of Forest History*.
Two Certificates of Merit, USDA, with cash awards
Society of American Foresters
Southeastern Section Technical award
Alabama Foresters' Hall of Fame
Fellow
Alpha Zeta: North Carolina State